UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AT&T SERVICES, INC.

Petitioner,

v.

USTA TECHNOLOGY, LLC,

Patent Owner.

Case IPR2025-01166
Patent No. RE47,720

PETITION FOR *INTER PARTES* REVIEW UNDER 35 U.S.C. § 312

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TABLE OF EXHIBITS

Exhibit	Short Name	Description
EX1001	’720 Patent	U.S. Patent No. RE47,720
EX1002	Shoemake Declaration	Declaration of Dr. Matthew Shoemake
EX1003	Shoemake CV	*Curriculum Vitae* of Dr. Matthew Shoemake
EX1004	’711 Patent	U.S. Patent No. 7,483,711
EX1005	’720 Prosecution History	File History of U.S. Patent No. RE47,720
EX1006	’711 Prosecution History	File History of U.S. Patent No. 7,483,711
EX1007	Walton	U.S. Patent App. Pub. No. 2003/0125040
EX1008	Hamabe	U.S. Patent App. Pub. No. 2001/0016499
EX1009	802.11a	IEEE-SA Standards Board, *IEEE Standard for Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: High Speed Physical Layer in the 5 GHz band*, December 30, 1999.
EX1010	USTA’s Infringement Contentions	USTA’s Amended Infringement Contentions, *USTA Technology, LLC v. AT&T Inc. et al*, No. 4-24-cv-00513 (E.D. Tex. June 7, 2024).
EX1011	RESERVED	RESERVED
EX1012	Shoemake Paper	Shoemake et al., *High-Performance Wireless Ethernet*, IEEE Communications Magazine, pgs. 64-73, Vol. 39, Issue 11, November 2001.

Exhibit	Short Name	Description
EX1013	ERC/DEC/(99) 23	European Radiocommunications Committee, *ERC Decision of 29 November 1999 on the harmonized frequency bands to be designated for the introduction of High Performance Radio Local Area Networks (HIPERLANs)*, November 29, 1999.
EX1014	US Department of Commerce DFS Adoption	United States Department of Commerce News, *Agreement Reached Regarding U.S. Position on 5 GHz Wireless Access Devices*, January 31, 2003.
EX1015	US FCC Notice of Proposed Rulemaking for DFS	Federal Communications Commission, *Notice of Proposed Rulemaking*, June 4, 2003.
EX1016	802.11h PAR	Approval of Project Authorization Request for 802.11 Task Group h, December 13, 2000.
EX1017	TGh Philips Proposal	S. Choi et al., *Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN*, May 16, 2001.
EX1018	Kasslin TGh PPT	M. Kasslin, *Reasons for DFS Requirement in Europe*, July 2001, https://mentor.ieee.org/802.11/dcn/01/11-01-0442-00-000h-reasons-for-dfs-requirements.ppt (last accessed May 22, 2025).
EX1019	RESERVED	RESERVED
EX1020	Gubbi	U.S. Patent No. 6,934,752
EX1021	RESERVED	RESERVED
EX1022	Ylitalo	WO 2002/01732
EX1023	Smith	U.S. Patent No. 6,426,723
EX1024	Wi-Fi Alliance	*Securing Wi-Fi Wireless Networks with Today's Technologies*, Wi-Fi Alliance, February 6, 2003.

Exhibit	Short Name	Description
EX1025	802.11-1999	IEEE-SA Standards Board, *IEEE Standard for Telecommunications and Information Exchange Between Systems – Local and metropolitan area networks – Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*, August 20, 1999.
EX1026	Walton 802.11n Proposal	Ketchum et al., *PHY Design for Spatial Multiplexing MIMO WLAN*, July 2004.
EX1027	RESERVED	RESERVED
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EX1029	Zamat	U.S. Patent No. 5,896,421
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EX1031	Thumpudi	U.S. Patent No. 7,801,735
EX1032	Hirsch	U.S. Patent App. Pub. No. 2003/0128659
EX1033	Larsson	U.S. Patent App. Pub. No. 2002/0172186
EX1034	Salz	J. Salz et al, *The Capacity of Wireless Communication Systems Can Be Substantially Increased by the Use of Antenna Diversity*, *IEEE Universal Personal Communications Conference* (September 1992)
EX1035	Foschini	Gerard J. Foschini, *Layered Space-Time Architecture for Wireless Communication in a Fading Environment When Using Multi-Element Antennas*, Bell Laboratories Technical Journal, 1996
EX1036	Raleigh2	G. G. Raleigh, *Spatio-Temporal Coding for Wireless Communication*, IEEE Transactions on Communications, Vol. 46, No. 3, March 1998.

Exhibit	Short Name	Description
EX1037	802.11e Draft D1.0	IEEE-SA Standards Board, *Draft Supplement to STANDARD FOR Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: Medium Access Control (MAC) Enhancements for Quality of Service (QoS)*, March 2001.
EX1038	Atheros Dual-Band	McFarland et al, *A 2.4 & 5 GHz Dual Band 802.11 WLAN Supporting Data Rates to 108 Mb/s*, 2002 IEEE GaAs Digest, 2002.
EX1039	Fallon	U.S. Patent No. 6,195,024
EX1040	Greenberger	U.S. Patent No. 6,675,187
EX1041	Onggosanusi	U.S. Patent No. 7,698,616
EX1042	Murtagh	E. M. Murtagh et al, *Outdoor Walking Speeds of Apparently Healthy Adults: A Systematic Review and Meta-analysis*, Sports Medicine, Vol. 51, pp. 125-141, published October 8, 2020.

CLAIM LISTING

Claim	Limitation #	Limitation
19	[19.pre]	A method for managing interference in a radio communications network, comprising the steps of:
	[19.1]	receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;
	[19.2]	filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;
	[19.3]	transmitting the filtered transmission signal to the second node;
	[19.4]	separately from the receipt of the instruction, receiving a compressed first feedback from the second node that is based on a received power and one or more frequencies of a first signal transmitted from the first node to the second node;
	[19.5]	separately from the receipt of the instruction, receiving a compressed second feedback from a third node that is based on a received power and one or more frequencies of a second signal transmitted from the first node to the third node;
	[19.6]	decompressing the compressed first feedback resulting in a decompressed first feedback;
	[19.7]	decompressing the compressed second feedback resulting in a decompressed second feedback;
	[19.8]	generating one or more data structures based on the decompressed first feedback and the decompressed second feedback;
	[19.9]	wherein the filtered transmission signal is a filtered first transmission signal that is transmitted using a first frequency and an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas, using a first power that is based on at least one of the one or more data structures; and further comprising:

Claim	Limitation #	Limitation
	[19.10]	transmitting, using a second frequency and the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node, using a second power that is based on at least one of the one or more data structures.
22	[22.1]	The method of claim 19, wherein the instruction includes a first instruction, and further comprising:
	[22.2]	receiving at the first node in the radio communications network a second instruction transmitted from the third node to avoid using a different plurality of frequencies to transmit to the third node; and
	[22.3]	filtering a second transmission signal to remove power from the second transmission signal at each frequency in the different plurality of frequencies to be avoided, resulting in the filtered second transmission signal.
23	[23.1]	The method of claim 19, wherein the first power and the second power are the same.
24	[24.1]	The method of claim 19, wherein the first power and the second power are different.
25	[25.1]	The method of claim 19, wherein an update of the compressed first feedback is repeatedly received at time periods of less than one second, and the first power is repeatedly updated based on an updated decompressed first feedback at time periods of less than one second; and an update of the compressed second feedback is repeatedly received at time periods of less than one second, and the second power is repeatedly updated based on an updated decompressed second feedback at time periods of less than one second.
26	[26.1]	The method of claim 19, wherein the filtered first transmission signal and the filtered second transmission signal are transmitted via the same transceiver.
27	[27.1]	The method of claim 19, wherein the filtered first transmission signal and the filtered second transmission signal are transmitted via different transceivers.
28	[28.1]	The method of claim 19, wherein the instruction is received utilizing a dedicated channel.

Claim	Limitation #	Limitation
29	[29.1]	The method of claim 19, wherein the instruction is received via an antenna configured for omnidirectional communication.
30	[30.1]	The method of claim 19, wherein the compressed first feedback and the compressed second feedback are received utilizing a dedicated channel.
31	[31.1]	The method of claim 19, wherein the compressed first feedback and the compressed second feedback are received via an antenna configured for omnidirectional communication.
32	[32.1]	The method of claim 19, wherein the decompressed first feedback and the decompressed second feedback are used to increase spatial separation among transmissions.
33	[33.1]	The method of claim 19, wherein the decompressed first feedback and the decompressed second feedback are used to increase spatial separation among transmissions at the same frequency.
36	[36.1]	The method of claim 19, wherein the compressed first feedback is based on a received power at a plurality of frequencies via which the first signal is received.
37	[37.1]	The method of claim 19, wherein the instruction is received prior to the receipt of the compressed first feedback.
38	[38.1]	The method of claim 19, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal via the same plurality of antennas.
39	[39.1]	The method of claim 19, wherein the first frequency is selected as a function of the compressed first feedback, and the second frequency is selected as a function of the compressed second feedback.
40	[40.1]	The method of claim 19, wherein the instruction includes a 802.11 clear to send (CTS) instruction.
41	[41.1]	The method of claim 19, wherein the instruction includes a 802.11 request to send (RTS) instruction.
42	[42.1]	The method of claim 19, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal via at least one different antenna of the plurality of antennas.

Claim	Limitation #	Limitation
43	[43.1]	The method of claim 19, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal using the at least one antenna of the plurality of antennas.
45	[45.1]	The method of claim 19, wherein the removal of power from the transmission signal at each frequency in the plurality of frequencies to be avoided is accomplished by adjusting a processing of the transmission signal so that certain power that was previously used in connection with the transmission signal at each frequency in the plurality of frequencies to be avoided before the instruction is received, is no longer used in connection with the transmission signal at each frequency in the plurality of frequencies to be avoided in accordance with the instruction.
46	[46.1]	The method of claim 19, wherein the removal of power from the transmission signal at each frequency in the plurality of frequencies to be avoided is accomplished by adjusting a processing of the transmission signal so that certain power that was previously used in connection with the transmission signal at each frequency in the plurality of frequencies to be avoided before the instruction is received, is no longer used in connection with the transmission signal at each frequency in the plurality of frequencies to be avoided in accordance with the instruction, which specifies at least one frequency to use so as to avoid using the plurality of frequencies to be avoided in order to transmit to the second node.
47	[47.1]	The method of claim 19, wherein network forwarding decisions are guided using instantaneous information from a media access control (MAC) layer.
48	[48.1]	The method of claim 47, wherein the network forwarding decisions are guided to eliminate a dominant end-to-end latency effect of channel access delay at at least one hop.
49	[49.1]	The method of claim 19, wherein frequency channels are reused in order to increase spatial reuse across multiple basic service sets.
50	[50.1]	The method of claim 19, wherein RTS/CTS signaling is extended such that frequency channels are reused in order to increase spatial reuse across multiple basic service sets.

Claim	Limitation #	Limitation
51	[51.1]	The method of claim 19, wherein RTS/CTS signaling is extended such that frequency channels are reused in order to increase spatial reuse across multiple basic service sets, to accommodate legacy access points.
52	[52.pre]	A method for managing interference in a radio communications network, comprising the steps of:
	[52.1]	receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;
	[52.2]	filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;
	[52.3]	transmitting the filtered transmission signal to the second node;
	[52.4]	wherein the instruction includes a first instruction and the filtered transmission signal includes a filtered first transmission signal that is transmitted to the second node using a first power via an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol, and further comprising:
	[52.5]	receiving at the first node in the radio communications network a second instruction transmitted from a third node in the radio communications network to avoid using a different plurality of frequencies to transmit to the third node;
	[52.6]	filtering a second transmission signal to remove power from the second transmission signal at each frequency in the different plurality of frequencies to be avoided; and
	[52.7]	transmitting, using a second power via the 802.11-based OFDM protocol and simultaneously with the filtered first transmission signal, the filtered second transmission signal to the third node.
53	[53.pre]	A method for managing interference in a radio communications network, comprising the steps of:
	[53.1]	receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;

Claim	Limitation #	Limitation
	[53.2]	filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;
	[53.3]	transmitting the filtered transmission signal to the second node;
	[53.4]	receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;
	[53.5]	receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;
	[53.6]	decompressing the compressed first feedback resulting in a decompressed first feedback; and
	[53.7]	decompressing the compressed second feedback resulting in a decompressed second feedback;
	[53.8]	wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas, using a first power that is based on the decompressed first feedback; and further comprising:
	[53.9]	transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.
54	[54.1]	The method of claim 53, wherein the instruction includes a first instruction, and further comprising:
	[54.2]	receiving at the first node in the radio communications network a second instruction transmitted from the third node to avoid using a different plurality of frequencies to transmit to the third node; and
	[54.3]	filtering a second transmission signal to remove power from the second transmission signal at each frequency in the different plurality of frequencies to be avoided, resulting in the filtered second transmission signal.
55	[55.1]	The method of claim 53, wherein the first power and the second power are the same.

Claim	Limitation #	Limitation
56	[56.1]	The method of claim 53, wherein the first power and the second power are different.
57	[57.1]	The method of claim 53, and further comprising: generating a first data structure based on the decompressed first feedback, where the first power is based on the first data structure; and
	[57.2]	generating a second data structure based on the decompressed second feedback, where the second power is based on the second data structure.
58	[58.1]	The method of claim 57, wherein the first data structure and the second data structure are different.
60	[60.1]	The method of claim 57, wherein the first data structure is unique to the second node, and the second data structure is unique to the third node.
61	[61.1]	The method of claim 57, wherein the first data structure is a first profile, and the second data structure is a second profile.
62	[62.1]	The method of claim 57, wherein the first data structure is a first optimal waveform profile.
63	[63.1]	The method of claim 53, and further comprising: generating a single data structure based on the decompressed first feedback and the decompressed second feedback, where both the first power and the second power are based on the single data structure.
64	[64.1]	The method of claim 53, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal via the same plurality of antennas.
65	[65.1]	The method of claim 53, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal via at least one different antenna of the plurality of antennas.
66	[66.1]	The method of claim 53, wherein the filtered second transmission signal is transmitted simultaneously with the filtered first transmission signal via the at least one antenna of the plurality of antennas.

Claim	Limitation #	Limitation
67	[67.1]	The method of claim 53, wherein an update of the compressed first feedback is repeatedly received, and the first power is repeatedly updated based on an updated decompressed first feedback; and an update of the compressed second feedback is repeatedly received, and the second power is repeatedly updated based on an updated decompressed second feedback.
68	[68.1]	The method of claim 53, wherein an update of the compressed first feedback is repeatedly received in real-time, and the first power is repeatedly updated in real-time based on an updated decompressed first feedback; and an update of the compressed second feedback is repeatedly received in real-time, and the second power is repeatedly updated in real-time based on an updated decompressed second feedback.
69	[69.1]	The method of claim 53, wherein an update of the compressed first feedback is repeatedly received at time periods of less than one second, and the first power is repeatedly updated based on an updated decompressed first feedback at time periods of less than one second; and an update of the compressed second feedback is repeatedly received at time periods of less than one second, and the second power is repeatedly updated based on an updated decompressed second feedback at time periods of less than one second.
70	[70.1]	The method of claim 53, wherein the filtered first transmission signal and the filtered second transmission signal are sent via the same transceiver.
71	[71.1]	The method of claim 53, wherein the filtered first transmission signal and the filtered second transmission signal are sent via different transceivers.
72	[72.1]	The method of claim 53, wherein the compressed first feedback and the compressed second feedback are received utilizing a dedicated channel.
73	[73.1]	The method of claim 53, wherein the compressed first feedback and the compressed second feedback are received via an antenna configured for omnidirectional communication.

Claim	Limitation #	Limitation
74	[74.1]	The method of claim 53, wherein the decompressed first feedback and the decompressed second feedback are used to increase spatial separation among transmissions.
75	[75.1]	The method of claim 53, wherein the decompressed first feedback and the decompressed second feedback are used to increase spatial separation among transmissions at the same frequency.
77	[77.1]	The method of claim 53, wherein the compressed first feedback is based on a received power and one or more frequencies via which the first signal is communicated.
78	[78.1]	The method of claim 53, wherein the compressed first feedback is based on a received power at a plurality of frequencies via which the first signal is communicated.
79	[79.1]	The method of claim 53, wherein the compressed first feedback is based on a series of power values as a function of frequency.
80	[80.1]	The method of claim 53, wherein the compressed first feedback includes a data structure that is based on a series of power values as a function of frequency.
81	[81.1]	The method of claim 53, wherein the instruction is received prior to the receipt of the compressed first feedback.
82	[82.1]	The method of claim 53, wherein the instruction is received separately with respect to the receipt of the compressed first feedback.
83	[83.1]	The method of claim 53, wherein at least three transmission signals are capable of being simultaneously transmitted to at least three different devices, using the same multiple antennas.
84	[84.1]	The method of claim 53, wherein at least three transmission signals are capable of being simultaneously transmitted to at least three different devices, using at least one different antenna.
85	[85.1]	The method of claim 53, wherein the instruction includes a request to send (RTS) instruction.
86	[86.1]	The method of claim 53, wherein the instruction includes a 802.11 clear to send (CTS) instruction.

Claim	Limitation #	Limitation
87	[87.1]	The method of claim 53, wherein the filtered first transmission signal is transmitted using a frequency band that is selected based on the instruction and the filtered second transmission signal is transmitted using the frequency band that is selected based on another instruction received from the third node, where the filtered first transmission signal is transmitted using a first frequency in the frequency band and the filtered second transmission signal is transmitted using a second frequency in the frequency band.
88	[88.1]	The method of claim 53, wherein the filtered first transmission signal is transmitted using a first frequency and the filtered second transmission signal is transmitted using a second frequency.
89	[89.1]	The method of claim 53, wherein the filtered first transmission signal and the filtered second transmission signal are transmitted using the same one or more frequencies.
90	[90.1]	The method of claim 53, wherein the filtered first transmission signal and the filtered second transmission signal are transmitted using the same frequency band.
91	[91.1]	The method of claim 53, wherein the filtered first transmission signal is transmitted using a first frequency that is based on the instruction and the filtered second transmission signal is transmitted using a second frequency that is based on another instruction received from the third node.
92	[92.1]	The method of claim 53, wherein the filtered first transmission signal is transmitted using a frequency that is based on the instruction and the filtered second transmission signal is transmitted using the frequency that is based on another instruction received from the third node.
93	[93.1]	The method of claim 53, wherein the filtered first transmission signal is transmitted using a frequency band that is selected based on the instruction and the filtered second transmission signal is transmitted using the frequency band that is selected based on another instruction received from the third node.

Claim	Limitation #	Limitation
95	[95.pre]	A method for managing interference in a radio communications network, comprising the steps of:
	[95.1]	receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;
	[95.2]	filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;
	[95.3]	transmitting the filtered transmission signal to the second node;
	[95.4]	separately from the receipt of the instruction, receiving a particular signal at the first node that is transmitted from the second node;
	[95.5]	generating a feedback based on a received power and one or more frequencies via which the particular signal is received;
	[95.6]	compressing the feedback; and
	[95.7]	transmitting the compressed feedback from the first node to the second node, for use by the second node in determining a transmit power with which the second node transmits to the first node via at least one antenna of a plurality of antennas, while simultaneously transmitting to one or more other nodes;
	[95.8]	wherein the filtered transmission signal is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol;
	[95.9]	wherein an update of the compressed feedback is repeatedly generated, compressed, and transmitted at time periods of less than one second; so that the transmit power is repeatedly updated based thereupon at time periods of less than one second.

Claim	Limitation #	Limitation
96	[96.1]	The method of claim 95, wherein the instruction includes a first instruction and the filtered transmission signal includes a filtered first transmission signal, and further comprising:
	[96.2]	receiving at the first node in the radio communications network a second instruction transmitted from a third node in the radio communications network to avoid using a different plurality of frequencies to transmit to the third node;
	[96.3]	filtering a second transmission signal to remove power from the second transmission signal at each frequency in the different plurality of frequencies to be avoided; and
	[96.4]	transmitting the filtered second transmission signal to the third node.

I. INTRODUCTION

The Challenged Claims generally relate to a first node "simultaneously" transmitting to second/third nodes "[first/second] transmissions signals" that are "filtered" to remove powers from certain frequencies specified by a received "instruction" "to avoid using a plurality of frequencies." The first/second transmission signals are transmitted "using a [first/second] frequency and the 802.11-based OFDM protocol" and using "a [first/second] power that is based on at least one of the one or more data structures" derived from received feedback. *E.g.*, EX1001, claim 19. This was not new or nonobvious.

Walton discloses a "multi-user MIMO" system in which "a [blue] transmitter unit may send multiple independent data streams on the same communication channel to [] multiple [green, red] receiver units" using OFDM and based on receipt of "compressed" "full CSI" feedback.

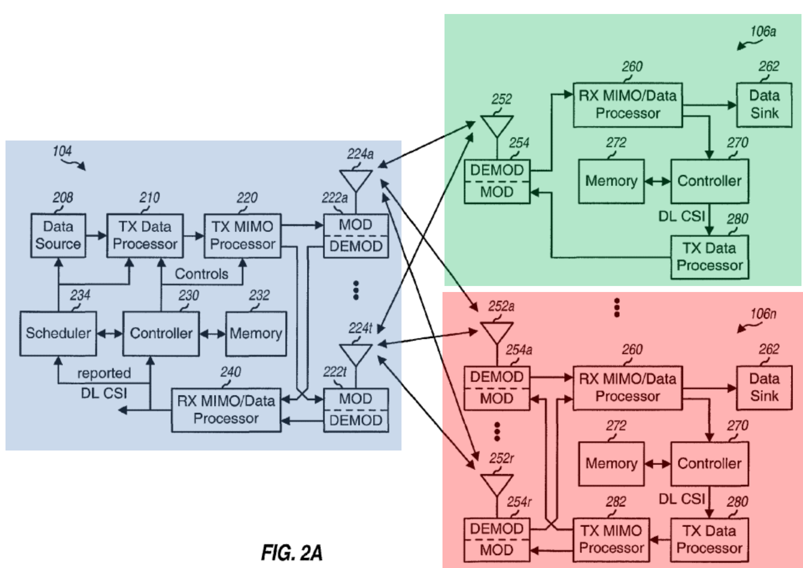

FIG. 2A

EX1007, [0051]-[0055], [0080]-[0082], [0323]-[0326], FIG. 2A (annotated). This matches PO's infringement theory. EX1002, ¶¶83, 105, 108, 128.

Walton explicitly proposes employing its disclosures in an OFDM wireless LAN system (EX1007, [0010], [0055]), rendering it obvious to employ Walton in combination with the known IEEE 802.11a Wi-Fi standard. EX1002, ¶¶85-88. Further, based on the explicit statements of the 802.11 task group that "enabl[ing] regulatory acceptance of 802.11 5 GHz products" required adding mechanisms "to detect radars and change channel accordingly" (EX1016, 5-6/7; *see also* EX1002, ¶¶73-75), a POSITA would have been motivated to seek out such known solutions, including Hamabe. EX1002, ¶89.

Hamabe discloses methods to "determine[] that the carrier frequency must be changed in order to avoid" "interference" and communicate and implement that determination. EX1008, [0117]. In one method, the mobile terminal "determines that the carrier frequency must be changed" and "transmits the control information to" access point 104 that "contain[s] the results of this determination." *Id.*, [0127], [0119], [0124]. That "control information" is an "instruction" "to avoid using a plurality of frequencies" as recited in Claims 19, 52, and 53. EX1002, ¶¶104-105. In another method, the access point makes the determination and sends the mobile terminal "a notification to start the process of changing the carrier frequency." EX1008, [0144]-[0149]. That notification" is an "instruction" "to avoid using a plurality of frequencies" as recited in Claim 95. EX1002, ¶232. In either case, the terminal will perform standard 802.11a standard channelization (EX1009, 11, 34-36/90) and "PPDU encoding process," "time windowing," and "spectral mask" requirements (*id.*, 15-19, 37/90) for the newly-selected 802.11a channel, which matches PO's infringement theory for receipt and use of the instruction. EX1002, ¶¶106-109, 233.

Accordingly, Walton/802.11a/Hamabe renders obvious the challenged claims as interpreted in PO's infringement mapping.

II. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest (37 C.F.R. §42.8(b)(1))

The real parties-in-interest are AT&T Services, Inc. (Petitioner), AT&T Mobility LLC and AT&T Mobility II LLC, each of which is a direct or indirect subsidiary of AT&T Inc. (NYSE: T).

B. Related Matters (37 C.F.R. §42.8(b)(2))

1. Litigation

Petitioner is aware of the following judicial matters involving the '720 Patent:

Case Heading	Number	Court	Filed
USTA Technology, LLC v. Motorola Mobility LLC et al	*3-24-cv-02659*	N.D. Tex.	October 23, 2024
USTA Technology, LLC v. AsusTek Computer Inc. et al	*4-24-cv-00512*	E.D. Tex.	June 7, 2024
USTA Technology, LLC v. AT&T Inc. et al ("the Litigation")	*4-24-cv-00513*	E.D. Tex.	June 7, 2024
USTA Technology, LLC v. Lenovo Group Limited et al	*4-24-cv-00515*	E.D. Tex.	June 7, 2024
USTA Technology, LLC v. LG Electronics, Inc. et al	*4-24-cv-00516*	E.D. Tex.	June 7, 2024
USTA Technology, LLC v. Samsung Electronics Co., Ltd. et al	*4-24-cv-00517*	E.D. Tex.	June 7, 2024
USTA Technology, LLC v. Google LLC	*4-23-cv-03748*	N.D. Cal.	July 27, 2023
USTA Technology, LLC v. Google LLC f/k/a Google Inc.	*6-22-cv-00485*	E.D. Tex.	November 22, 2022

2. Administrative Proceedings

The ’720 Patent is subject to a pending *ex parte* reexamination proceeding, Application No. 90/019,702 filed by Unified Patents, LLC. The ’720 Patent is also subject to a pending *inter partes* review (IPR2025-00838) filed by Intel Corp. and Lenovo (United States) Inc. Petitioner is neither in privy nor a real party-in-interest with any of these entities.

C. Designation of Counsel (37 C.F.R. §42.8(b)(3))

Petitioner provides the following designation of counsel.

Lead Counsel	Backup Counsel
Eagle H. Robinson Reg. No. 61,361	Daniel S. Leventhal Reg. No. 59,576 Talbot Hansum Reg. No. 72,604 G. Duncan Waldrop Reg. No. 83,028

D. Service Information (37 C.F.R. §42.8(b)(4))

Lead Counsel	Backup Counsel
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Petitioner consents to electronic service.

III. GROUNDS FOR STANDING

Petitioner certifies that the ’720 Patent is available for IPR, and that Petitioner is not barred or estopped from requesting IPR.

IV. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

A. Claims for Which Review Is Requested (37 C.F.R. § 42.104(b)(1))

Petitioner requests cancellation of Claims 19, 22-33, 36-43, 45-58, 60-75, 77-93, 95, and 96 (“Challenged Claims”).

B. Statutory Grounds of Challenge (§42.104(b)(2))[1]

Ground 1: Claims 19, 22-33, 36-43, 45, 46, 49-58, 60-75, 77-93, 95, and 96 are unpatentable under §103 over 2003/0125040 (“Walton”) (EX1007) in view of 802.11a-1999 (EX1009, EX1025)[2] and 2001/0016499 (“Hamabe”) (EX1008).

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[1] All Grounds are supported by a POSITA’s general knowledge. *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337-38 (Fed. Cir. 2020).

[2] 802.11a-1999 is made up of “IEEE Std 802.11a-1999” (EX1009) and the incorporated-by-reference “802.11, 1999 Edition” (EX1025). EX1009, 9/90 (instructions to reader on how to “merge” the two publications). To the extent “802.11, 1999 Edition” is found not to be incorporated by reference, it would have been obvious to a POSITA to combine the two references based on the explicit instructions to do so. EX1002, ¶62, EX1009, 9/90.

Walton was filed November 6, 2001, published July 3, 2003, and is thus prior art under at least pre-AIA §102(e). EX1007. IEEE Std 802.11a-1999 (EX1009) was published on December 30, 1999 and the incorporated-by-reference IEEE Std 802.11, 1999 Edition (EX1025) was published August 20, 1999, and is thus prior art under at least pre-AIA §§102(a), (b). EX1009, 1/90; EX1025, 3/528; EX1002, ¶¶73-75. Hamabe was filed February 22, 2001, published August 23, 2001, and is thus prior art under at least pre-AIA §§102(a), (e). EX1008.

Ground 2: Claims 47 and 48 are unpatentable under §103 over Walton/802.11a-1999/Hamabe further in view of U.S. Patent No. 6,934,752 ("Gubbi") (EX1020). Gubbi was filed July 13, 2000, and is thus prior art under at least pre-AIA §102(e).

V. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art ("POSITA") would have had at least (1) a master's degree in electrical engineering, computer engineering, computer science, or a similar field, and (2) at least two years of academic or industry experience designing physical and medium access control protocols for wireless network protocols. EX1002, ¶47. A POSITA would have been aware of major industry standards including IEEE 802.11 (Wi-Fi), IEEE 802.3 (Ethernet), cellular, and IETF (Internet). *Id.* The prior art evidences this level of ordinary skill. *Id.* Additional education might substitute for some experience, and vice versa. *Id.*

Here, the background technology described in Section VI and the prior art described in Section IX demonstrate that a POSITA would have been familiar with the underlying principles of wireless local area network (WLAN) protocols, including wireless transceiver designs, MIMO technologies (which are not mentioned in the ’720 Patent, but would have been within the knowledge of a POSITA at the time), the existing 802.11 (Wi-Fi) standards, and the active 802.11 task groups further developing Wi-Fi technology. *Id.*, ¶48.

VI. FIELD OF TECHNOLOGY

A. Multiple Input Multiple Output (MIMO) Wireless Technology

Well before the earliest claimed priority date (ECPD), the Multiple Input Multiple Output (MIMO) concept and advantages that “can be achieved by the use of spatial diversity (multiple antennas), and optimum combining” were known. EX1034, 2/6; EX1002, ¶¶49-52; EX1035, 1-2/19; EX1036, 1-3/10. Also before the ECPD, because obtaining multipath gain requires selecting superior paths through the channel, techniques had been developed to select the best paths through the channel. EX1002, ¶¶53-59; EX1007, [0115]-[0124], [0168]. Walton discloses “a multiple-access communication system” for a “LAN,” including “access point[s]” and “terminals,” that “utilize[s] orthogonal frequency division multiplex (OFDM)” and sends channel state information (CSI) feedback that enables “adaptively process[ing] data prior to transmission, based on channel state information, to more closely match the data transmission to the capacity of the channel." EX1007, [0043]-[0047], [0055], Abstract.

B. 802.11 Wireless Local Area Network (WLAN) Standards and Regulatory Restrictions on Use of Shared Spectrum

"The IEEE 802.11 WLAN standard," "Wi-Fi," "is part of a family of IEEE local and metropolitan networking standards." EX1012, 3/11; EX1024, 4/10. Printed publications describing Wi-Fi developments included final standards as well as study items and proposals developed by IEEE working groups. EX1002, ¶¶61, 73-75.

By the ECPD, IEEE had published 802.11a-1999, which defined a "high-speed Physical Layer in the 5 GHz band" using "OFDM" that instructed the reader to "merge" the specification "into IEEE Std 280.11, 1999 Edition, to form the new comprehensive standard." EX1009, 9-11/90. "In IEEE 802.11, the addressable unit is a station (STA)." EX1025, 24/528. "An access point (AP) is a STA that provides access to the [distribution system (DS)] by providing DS services in addition to acting as a STA." *Id.*, 26/528. The '720 Patent recognizes IEEE 802.11a as prior art. EX1001, 19:42-45.

Wi-Fi is designed to operate in shared spectrum, including 802.11a's 5 GHz band. EX1002, ¶63. Therefore, the "fundamental access method of the IEEE 802.11 MAC is a [distributed coordination function] DCF known as carrier sense multiple access with collision avoidance (CSMA/CA)." EX1025, 85/528. "The exchange of

[Request To Send] RTS and [Clear To Send] CTS frames prior to the actual data frame is one means of distribution of this medium reservation information." *Id.*, 88/528.

Additionally, as regulatory agencies permitted WLAN use of the 5 GHz band, they required WLAN transmission to avoid interference with existing government users already operating in those bands. EX1002, ¶64; EX1009, 3-4/90 EX1013, 3-4/7; EX1014, 1/2; EX1015, 4/28. For example, the European Radiocommunications Committee (ERC) permitted WLAN ("HIPERLAN") operation in the 5 GHz band for WLAN equipment "capable of ***avoiding*** occupied channels by employing a Dynamic Frequency Selection mechanism …." EX1013, 4/7, 6/7.

In light of the ERC regulations in the 5 GHz band and the potential adoption of similar regulations in the United States, 802.11 task group h was launched on December 13, 2000 to "provide Dynamic Channel Selection and Transmit Power Control mechanisms" for 802.11 that would "enabl[e] regulatory acceptance of 802.11 5 GHz products." EX1016, 5/7; *see also* EX1002, ¶¶73-75. The task group h members understood that "avoid[ing] co-channel operation," as required by the ERC meant that "DFS must be able to detect radars and change channel accordingly." EX1018, 3/3; *see also* EX1013, 6/7; EX1002, ¶¶65, 73-75. Thus, by the ECPD, a POSITA implementing a Wi-Fi system was aware of the need to identify and avoid frequencies occupied by other systems. EX1002, ¶65.

The ’720 Patent recognizes the FCC’s “adoption of a policy of ‘Interference Protection,’ which defines an acceptable level of interference to primary users from secondary users” as the “need[]” the ’720 Patent was intended to address. EX1001, 1:35-63.

C. Detection and Avoidance of Occupied Frequencies

Methods for detecting and coordinating avoidance of occupied frequencies causing interference were well known in the wireless space by the ECPD. EX1002, ¶67. Hamabe discloses “an adjacent carrier frequency interference avoiding method” in which “the mobile station [] determines that the condition for changing the carrier frequency in order to avoid adjacent channel interference is satisfied” and “transmits the control information to the base station” reporting the determination. EX1008, [0097], [0119], [0127].

VII. THE ’720 PATENT

A. Overview

With the goal of “tak[ing] advantage of the proposed spectrum policies” “permit[ting] secondary (e.g., unlicensed) users to radiate” limited power where “primary (e.g., licensed)” users exist, the ’720 Patent proposes “measur[ing] the local spectrum at a receiving node,” “generat[ing] an optimal waveform profile specifying transmission parameters that will water-fill unused spectrum up to an interference limit,” and employing “closed loop feedback control.” EX1001, 1:35-

63, Abstract. In one example, the receiver analyzes a received OFDM waveform and "narrow band (25 KHz) excision of spectral spikes are used to minimize interference produced by legacy systems." *Id.*, 10:56-64. The receiver then transmits an "instruction," which "may be embodied in or combined with [the] optimal waveform profile" identifying those excisions. *Id.*, 3:6-10, 4:15-20. Based on the instruction, the transmitting node performs "transmit excision" by "filtering a transmission signal to remove power at frequencies that should be avoided. *Id.*, 4:12-14; *see also id.*, 22:8-17.

The '720 Patent also discloses "closed loop power control" for "frequencies corresponding to positive power differentials so that the receiver receives transmissions from all of its neighbors at the same power level." *Id.*, 3:37-43; *see also id.*, 10:22-37. The closed loop power control is accomplished using "feedback," embodied in a "request to adjust (or limit) [another node's] transmission power level," thus "minimiz[ing] the transmit power." *Id.*, 3:38-44; EX1002, ¶70.

The Challenged Claims, all of which were substantially amended or added during reissue, especially as interpreted in PO's infringement mapping, bear little resemblance to the '720 Patent's disclosure. First, PO asserts that the recited steps of receiving an "instruction" "to avoid using a plurality of frequencies," "filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided," and "transmitting the filtered transmission signal to the second node" (e.g., [19.1]-[19.3]), are met by a parameter embedded in a CTS message selecting the bandwidth for subsequent data packets and complying with known transmit spectral masks to the selected bands as defined in prior art 802.11 standards. EX1010, 31, 48, 52-53, 56-57/426.[3]

Second, PO asserts that the recited steps of receiving "compressed feedback," decompressing the" "compressed feedback," "generating one or more data structures based on the decompressed" feedback, transmitting the "filtered first transmission signal" "using a first power that is based on at least one of the one or more data structures," and transmitting a "filtered second transmission signal" "using a second power that is based on at least one of the one or more data structures" (e.g., [19.4]-[19.10]), correspond to receiving beamforming feedback and performing multi-user MIMO as in later 802.11 standards (after the ECPD). EX1010, 58-71/426.[4]

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[3] This is despite the fact that the '720 Patent states that the "present invention" "requires MAC protocol that is quite different from conventional carrier sense multiple access/collision detect (CSMA/CD) protocols, such as IEEE 802.11, which uses RTS/CTS exchanges." EX1001, 20:12-23.

[4] This is despite the fact that the '720 Patent does not mention MIMO or beamforming. EX1001, 20:12-23.

B. Original Prosecution

Application No. 10/689,763, which resulted in the ’711 Patent, was filed on October 22, 2003 and allowed on September 22, 2008 after a single Office Action in which the Examiner issued no rejections under 101, 102, or 103. EX1006, 14/166 (Notice of Allowance), 35/166 (Non-Final Office Action).

C. The 2018 Reissue

Ten years and four assignments later, Application No. 15/898,404 was filed on February 26, 2018 by current assignee and PO, USTA Technology LLC, as a reissue application of the ’711 Patent. EX1005, 18/357, 350-351/357 (assignment history). The reissue added over 70 new claims, including three new independent claims (52, 53, and 95). *See* EX1001, cls. 22-96. In the Notice of Allowance, the Examiner quoted a similar claim limitation in each of the independent claims in the stated reasons for allowance. EX1005, 25-27/357 (identifying “transmitting, using a second power via the 802.11 based OFDM protocol and simultaneously with the first transmission signal, the second transmission signal to the third node” in claim 39, which issued as claim 52).

VIII. CLAIM CONSTRUCTION

Petitioner interprets the Challenged Claims according to the *Phillips* claim construction standard. 83 Fed. Reg. 51340, 51340-44 (Oct. 11, 2018); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). For the reasons explained below, construction of these terms, or any others is not necessary to address the mappings presented in this Petition. In a number of instances identified below, Petitioner applies, without conceding as correct, PO's interpretation of the Challenged Claims as reflected in PO's infringement mapping. While Petitioner does not concede these interpretations are correct, because PO does not dispute them (indeed, they are PO's interpretations), it is not necessary for the Board to address any disputes or provide any formal constructions. Otherwise, the terms of the Challenged Claims can be given their plain and ordinary meaning for purposes of this proceeding. *See, e.g., Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

IX. REASONS FOR THE RELIEF REQUESTED (§§42.22(a)(2), 42.104(b)(4))

A. Ground 1: Walton, Hamabe, and 802.11a Render Obvious Claims 19, 22-33, 36-43, 45, 46, 49-58, 60-75, 77-93, and 95.

1. Walton

Walton discloses "a multiple access MIMO system" that "adaptively process[es] data prior to transmission, based on channel state information." EX1007, Abstract. Walton's MIMO system uses the channel state information (CSI) to "achieve better utilization of the available resources (e.g., transmit power and bandwidth) and robust performance for the downlink and uplink." *Id.*, [0010]. In several embodiments, discussed below, the CSI is the channel response matrix, *H*, itself, or a compressed approximation of it. EX1002, ¶76; *see* EX1007, [0091], [0312].

Walton discloses "a MIMO system utilizing OFDM" that can operate in various modes, including "multi-user MIMO mode." EX1007, [0048], [0062]-[0067], [0129]-[0136], FIG. 3E. In a MIMO OFDM system, "each spatial subchannel of each frequency subchannel" is "a transmission channel," a plurality of which make up the broader MIMO "communication channel" between a transmitter and one or more receivers. *Id.*, [0051]-[0052]. Using MIMO, "a transmitter unit may send multiple independent data streams on the same communication channel to [] multiple receiver units by exploiting the spatial dimensionality of the communication channel coupling the transmit and receive antennas." *Id.*, [0055]. Figure 2A depicts "a block diagram of a [blue] base station 104 and two [green, red] terminals 106 within system 100." *Id.*, [0076].

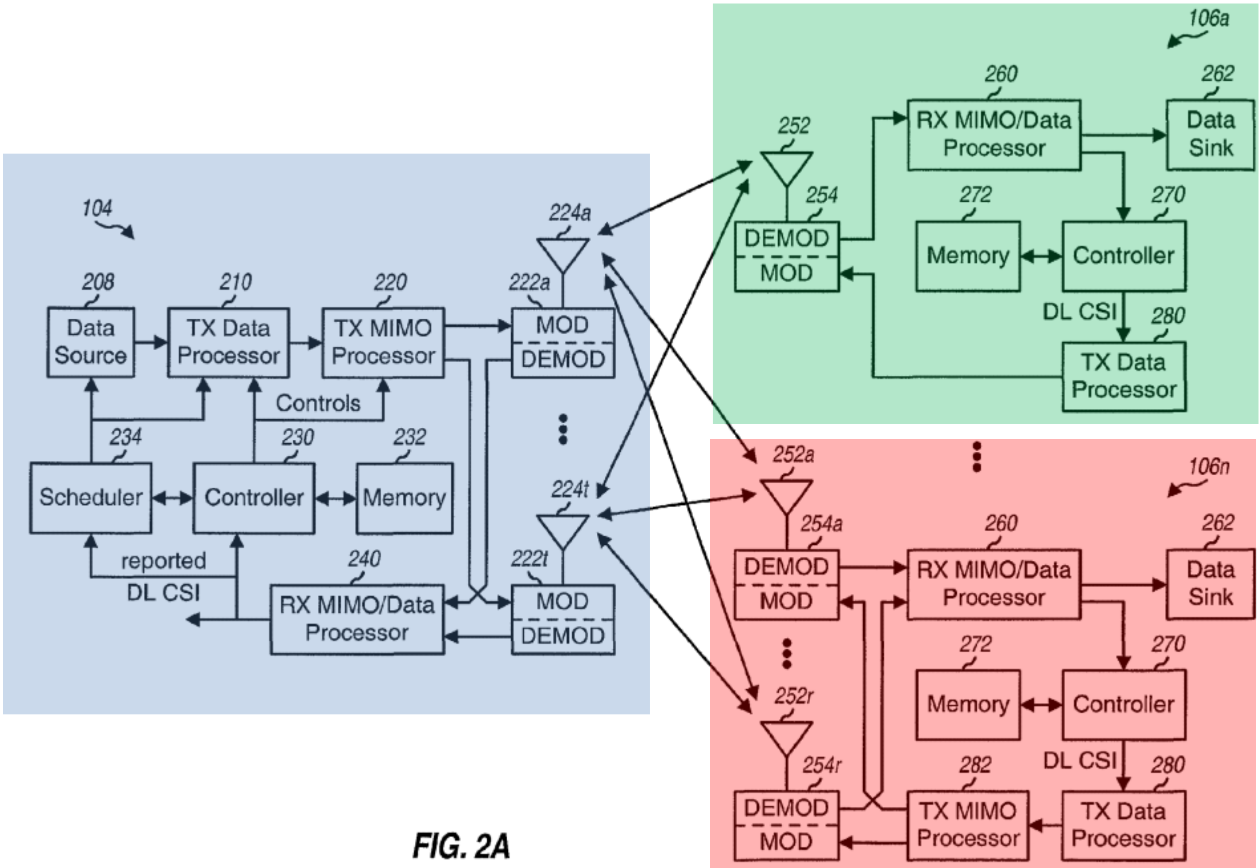


FIG. 2A

Id., FIG. 2A (annotated).

FIG. 3E (inset below) depicts "a transmitter unit 300e, which utilizes OFDM and is capable of independently processing data for each frequency subchannel" using CSI. *Id.*, [0130].

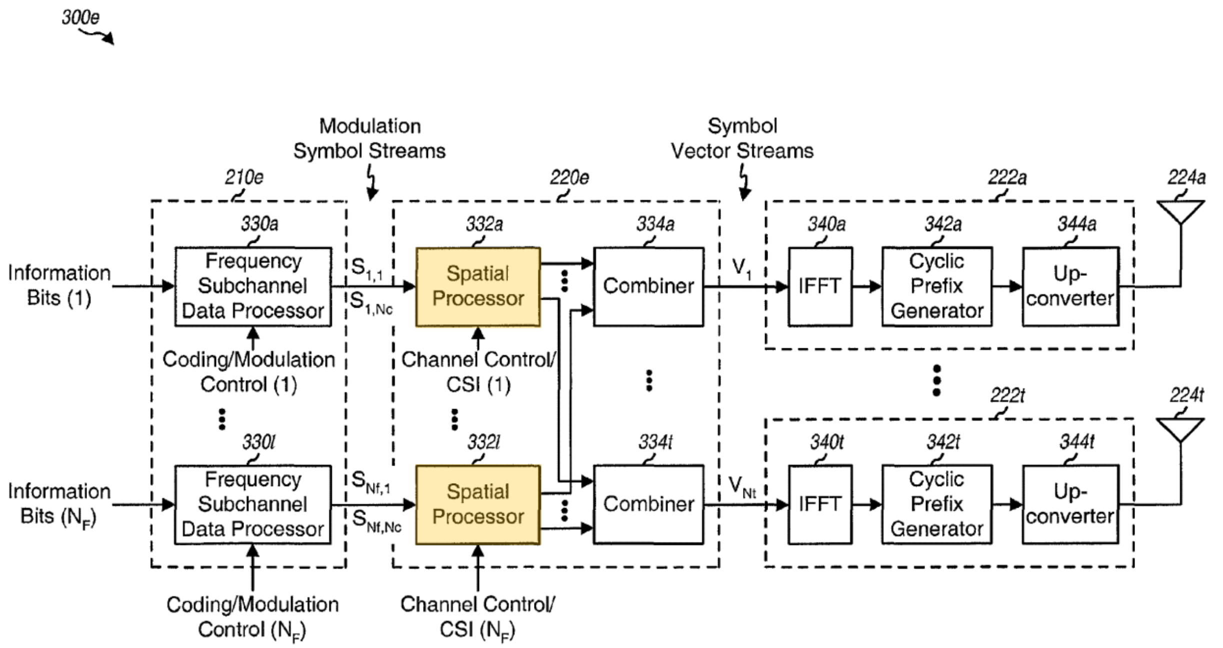


FIG. 3E

Id., FIG. 3E (annotated). "Each [orange] spatial processor 332 … may implement a MIMO processor followed by a demultiplexer (such as that shown in FIG. 3C below) if full-CSI processing is performed." *Id.*, [0131].

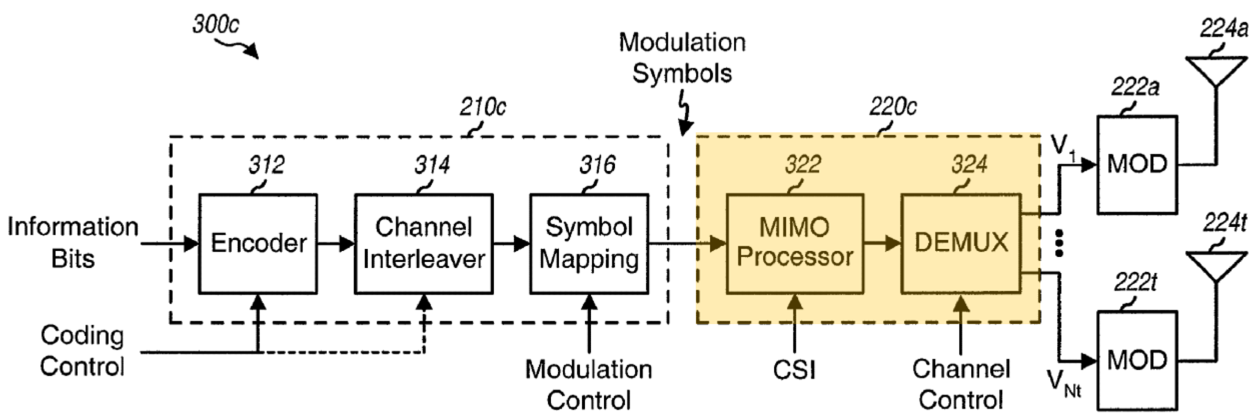


FIG. 3C

Id., FIG. 3C (annotated).

Walton also discloses several CSI embodiments that offer different balances between MIMO processing complexity, CSI feedback overhead, and the completeness of the channel characterization. *Id.*, [0303]-[0315]; EX1002, ¶¶79-80. In the configuration of Walton mapped in this Petition, the CSI is "full CSI [that] comprises eigenmodes [of the channel]," as well as "other information that is indicative of, or equivalent to, SNR." EX1007, [0312]. Walton explains that this full CSI may be compressed using "compression and feedback channel error recovery techniques to reduce the amount of data to be fed back." *Id.*, [0323]. Other applicable compression techniques were also known in the art. EX1002, ¶80; EX1031, 33:32-35:10.

2. IEEE 802.11a

As discussed in Section VI.B, IEEE 802.11a discloses a Wireless LAN employing an OFDM physical layer operating in the 5 GHz band, along with PHY and MAC layer functionality for carrier sense multiple access with collision avoidance (CSMA/CA) using RTS/CTS frames. EX1002, ¶81. The basic RTS/CTS exchange first involves the transmission of a RTS message from a STA that desires to send data on the network's channel. EX1025, 88-89/528. The addressed STA responds with a CTS. *Id.*, 98/528. It was known in the art that 802.11a's RTS/CTS frame structure could be modified to also include control information providing specific instructions as to how to perform communication. EX1002, ¶81; *see e.g.,* EX1032, [0048]; EX1033, [0029]-[0031], [0086], Fig. 7.

802.11a splits the 5 GHz band into 12 "channels," so that "overlapping and/or adjacent cells" may "operate simultaneously" "using different channels." EX1009, 34-35/90.

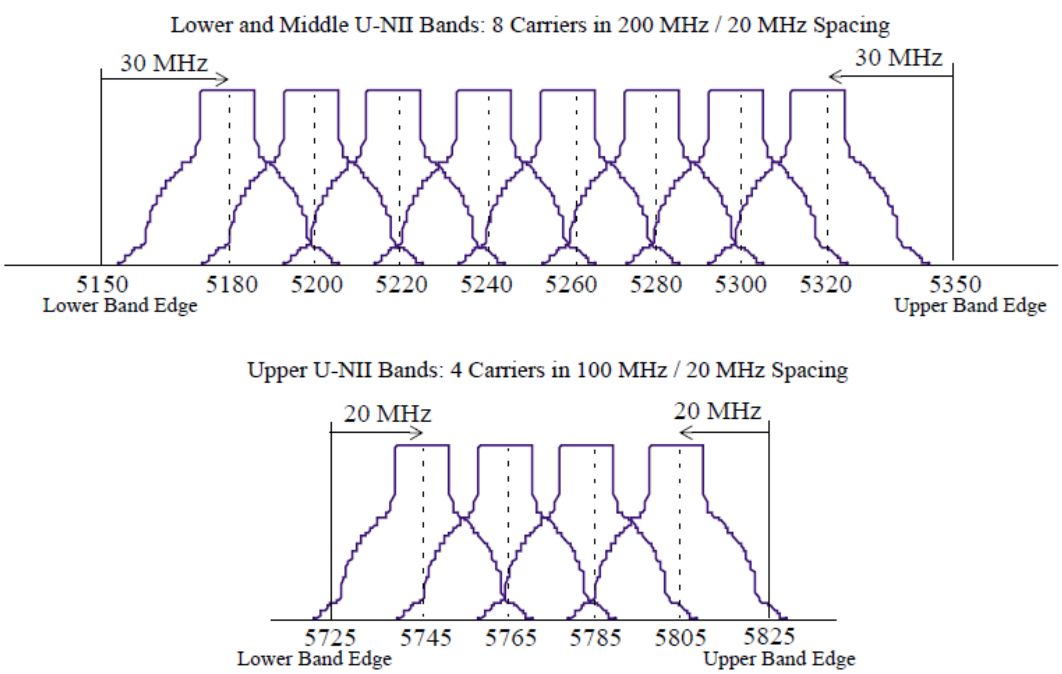


Figure 119—OFDM PHY frequency channel plan for the United States

Id., 35/90.

802.11a discloses a "PPDU encoding process" to generate the OFDM symbols and "[u]p-convert the resulting 'complex baseband' waveform to an RF frequency." *Id.*, 15-16/90. 802.11a also specifies that the "transmitted signals" must comply with "spectral mask and modulation accuracy requirements" and "[t]ime domain windowing, as described here, is just one way to achieve those objectives." *Id.*, 18-19/90. The spectrum mask is shown below:

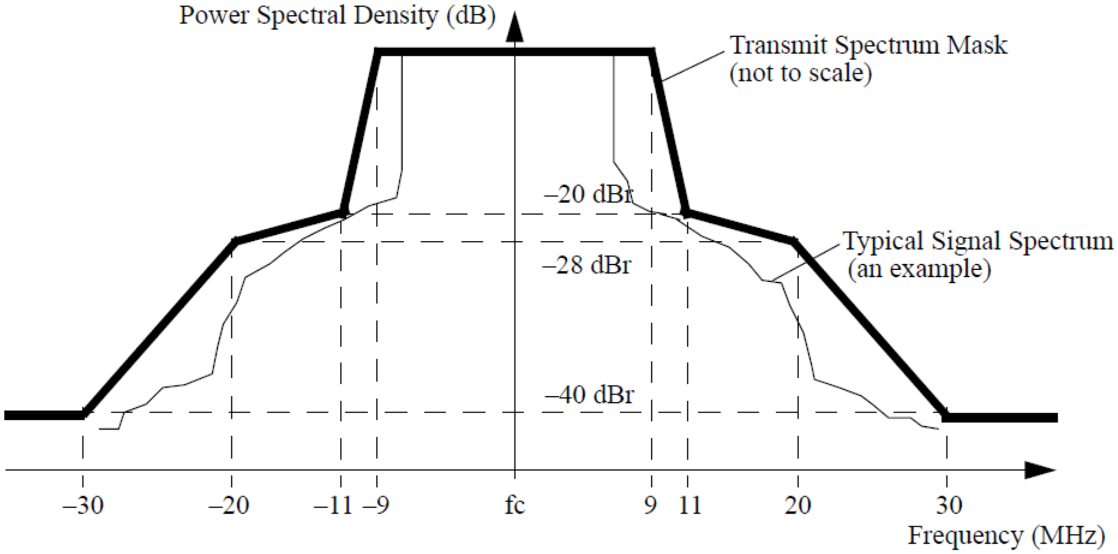


Figure 120—Transmit spectrum mask

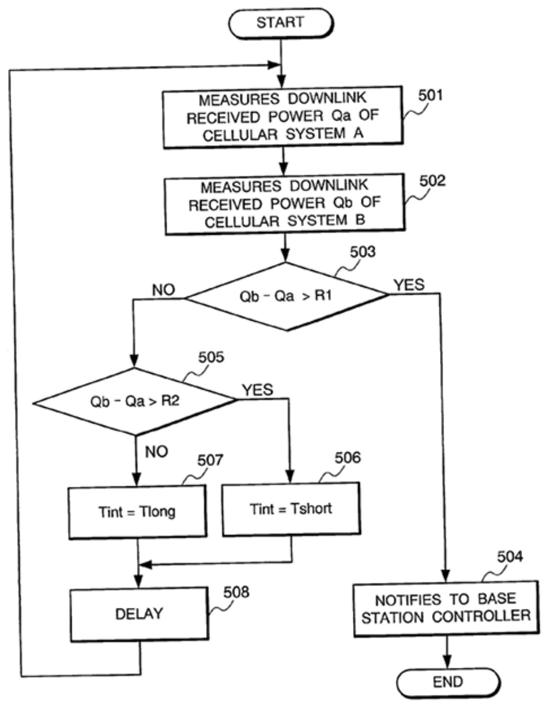
Id., 37/90.[5]

[5] PO pointed to "PPDU encoding process" and spectrum mask requirements that existed in 802.11a and were carried forward to 802.11ac to assert that 802.11ac-compliant devices meet Limitation [53.2]. EX1010, 48-53/426 (asserting that claimed filtering "is accomplished via a mask PPDU and resulting data scrambling. Further, power (that was used or could be used) is dynamically removed.").

3. Hamabe

Hamabe discloses a method to "determine[] that the carrier frequency must be changed in order to avoid adjacent frequency interference," then "assign[ing] a carrier frequency that is not adjacent to the carrier frequencies" of the interfering system. EX1008, [0117]. The mobile station "***measures*** the downlink received power Qa of Cellular System A" with which it is communicating and "the downlink received power Qb of Cellular System B" "in the same area." *Id.*, [0126], [0098]. If the mobile station "finds that the difference between the received power Qb and the received power Qa is greater than the predetermined threshold R1, the mobile station 21 ***determines*** that the carrier frequency must be changed." *Id.*, [0127]. The mobile station then "generates control information to notify [the base station] that the condition for changing the carrier frequency has been satisfied, and transmits the control information to the base station 11." *Id.*, [0127], [0119] ("the information to be sent by the mobile station 21 should contain the results of this determination"). When the base station receives this notification, it "begins the process of changing the carrier frequency," selecting frequencies "which are not adjacent to the carrier frequencies" of the other network. *Id.*, [0124].

FIG. 5



Id., FIG. 5, *see also id.*, [0125]-[0131].

4. Motivation to Combine

A POSITA would have been motivated to combine Walton's MIMO OFDM techniques with the OFDM PHY and MAC layer protocols of 802.11a based on Walton's explicit disclosures and the complementary nature of the disclosures. EX1002, ¶85.

First, Walton does not purport to describe a complete system, but rather discloses "***techniques*** that may be used to achieve better utilization of the available resources" that "may be advantageously employed in … an OFDM system." EX1007, [0010]. Because 802.11a is a wireless OFDM system, a POSITA would have been motivated based on Walton's explicit instruction to adopt the ***standard*** 802.11a system as the base for applying Walton's MIMO OFDM techniques. EX1002, ¶86.

Second, Walton states that the use of the disclosed MIMO system "is an effective technique for enhancing the capacity of multiple-access systems (e.g., cellular, PCS, ***LAN***, and so on)." EX1007, [0055]. Thus, a POSITA would be motivated to apply Walton's MIMO techniques to 802.11a based on Walton's specific identification of wireless LANs, for which 802.11a was a widely known standard, as systems that could obtain the benefit of enhanced capacity by applying Walton's techniques. EX1002, ¶87; EX1007, [0007], [0010] ("better utilization of the available resources" and "robust performance").[6]

Third, Walton and 802.11a's use of the same architecture and modulation demonstrates a likelihood of success. EX1002, ¶88. Walton teaches that "base station 104" "may also be referred to as an access point," the specific terminology

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[6] Consistent with Walton's explicit motivation, in July 2004, shortly after 802.11 began soliciting 802.11 MIMO proposals as part of 802.11 task group n, Walton's inventors and their team at Qualcomm proposed the MIMO techniques disclosed in Walton for use in the first version of 802.11 to include MIMO. EX1026; *see also* EX1002, ¶¶73-75.

used for a base station in 802.11. EX1007, [0043]; EX1025, 19/528; EX1002, ¶88. And Walton discloses use of OFDM as in 802.11a. EX1007, [0047]; EX1009, 3-4/90.

Next, based on the explicit motivation published by 802.11 task group h to "enabl[e] regulatory acceptance of 802.11 5 GHz products" by adding "Dynamic Channel Selection and Transmit Power Control mechanisms" that are "able to ***detect*** radars and ***change*** channel accordingly" (EX1016, 5-6/7, EX1018, 3/3), a POSITA would be motivated to seek existing teachings of interference detection and channel selection. EX1002, ¶89. Hamabe is one such reference, disclosing a method to "determine[] that the carrier frequency must be ***changed*** in order to avoid adjacent frequency interference." EX1008, [0117]; EX1002, ¶89. Hamabe's disclosure of a cellular base station or a mobile station detecting interference from geographically overlapping wireless systems (an adjacent base station in Hamabe) and exchanging instructions to change frequencies is analogous to access points and non-access point stations in a wireless LAN detecting interference from geographically overlapping wireless systems (such as existing radar system) and changing frequencies as described by the 802.11 h task force. *Id.* Thus, a POSITA would have been motivated to apply Hamabe's teachings to Walton/802.11a. *Id.*

5. *Modification of Walton in View of Hamabe and 802.11a*

Combining Walton's MIMO OFDM techniques with the OFDM PHY and MAC layer protocols of 802.11a results in adopting 802.11a's OFDM modulation and channelization, and 802.11a's CSMA/CA RTS/CTS protocols, into Walton. Walton's "[blue] base station 104" is thus implemented in the form of an 802.11 access point "and two [green, red] terminals" 106a and 106n are implemented in the form of 802.11 stations "within system 100" (the "radio communications network"). EX1007, [0076], FIG. 2A; EX1025, 24-26/528; EX1002, ¶90.

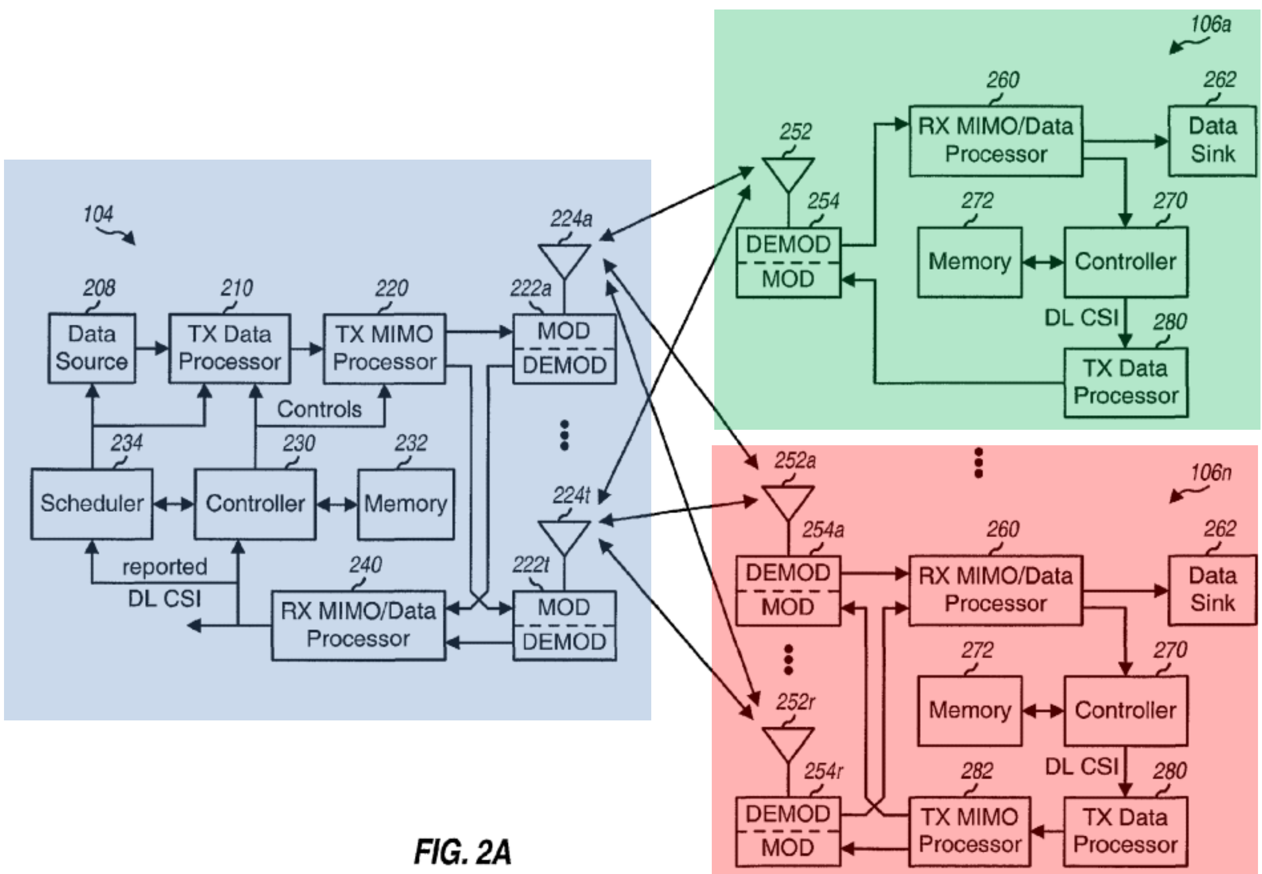

FIG. 2A

EX1007, FIG. 2A (annotated). In the combination, the base station/access point will be referred to as "access point 104" (adopting the terminology of 802.11a), but referring to the physical layer implementation disclosed in Walton. EX1002, ¶90.

Walton's references to "frequency subchannel" in its MIMO system (EX1007, [0054], [0132], FIG. 3E) correspond to 802.11a's OFDM subcarriers (EX1009, 11, 27-31/90). EX1002, ¶91. Combining the two, Walton's MIMO processing would be performed across the 52 subcarriers (or 48 data subcarriers) defined in 802.11a, which are used within each 20 MHz channel in the 5 GHz band. EX1002, ¶¶91-93; EX1009, 27-31, 35/90.

Next, a POSITA would turn to Hamabe to include functionality in Walton/802.11a to comply with the 5 GHz regulatory requirements discussed in Sections VI.B, IX.A.4 and recognized as prior art in the '720 Patent. EX1002, ¶94. Specifically, a POSITA would include in each terminal 106's functionality: (1) Hamabe's measuring and determining steps, but using the measurement target ("be able to detect radars" operating within the current channel) and criteria ("avoid[ing] co-channel operation") specified by the regulatory requirements; and (2) that, if "co-channel operation" is determined, terminal 106 performs Hamabe's steps of generating and transmitting "control information" (i.e., instruction) to the access point "to notify that the condition for changing the carrier frequency has been satisfied." EX1002, ¶¶94-95; EX1009, 3-4/90 EX1013, 3-4/7; EX1014, 1/2;

EX1015, 4/28 EX1008, [0126]-[0127]. That is, each terminal 106 would send and access point 104 would receive "control information" indicating that the current 802.11 channel includes interference from, for example, a radar, and instructing access point 104 to move to a different 802.11 channel. EX1002, ¶95. Because "various terminals 106 are dispersed throughout the system" (EX1007, [0043]-[0044], FIG. 1), a POSITA would understand that each terminal would implement Hamabe's method in order to detect interfering devices in various geographic locations within the system. EX1002, ¶95; *see also id.* ¶¶96-97.

In implementing Hamabe's "control information" messages and Walton's CSI feedback, a POSITA would have understood that 802.11a's existing structures for sending "control" and "management" frames could be used and modified to send this information. EX1025, 49-58/528; EX1002, ¶¶98-100. As a first example, it would have been obvious to modify the RTS and/or CTS frame formats defined by 802.11a to include Hamabe's "control information" by, for example, including an additional field in the MAC header defined for each message. EX1002, ¶¶98-99; EX1008, [0127]; EX1025, 56-57/528. Providing information on whether the current frequency can be used for transmission is consistent with the purpose of the RTS/CTS messages, which determine whether the channel is available for transmission. EX1002, ¶98. The obviousness of this approach is consistent with others reaching this solution several months before the inventor of the '720 Patent.

Id. (citing EX1033, Abstract, Figs. 7, 15, [0029]-[0031], [0086] disclosing adding an additional MAC control field to "RTS-CTS," "DATA," and "ACK" messages to "with directives of link adjustment" and EX1032, [0048] disclosing including a field specifying modulation format in an "RTS" frame and a field from the receiving station in a "CTS" frame indicating "whether accepts or refuses" the specified modulation).

As another example, it would also have been obvious to send Hamabe's "control information" and/or Walton's CSI in an 802.11a MAC management frame, an 802.11 frame format that was known in the art as the ideal format for sending larger payloads of network management information. EX1002, ¶100; EX1025, 65/528 ("Within management frames, fixed-length mandatory frame body components are defined as fixed fields; variable length mandatory and all optional frame body components are defined as information elements."). The obviousness of this approach is consistent with draft 802.11 standards predating the ECPD modifying management frame structure to include additional information. EX1002, ¶100 (citing EX1037, 42-43/90).

6. *Element-by-Element Analysis*

a. Claim 19

[19.pre]

To the extent the preamble is limiting, Walton/802.11a/Hamabe renders obvious Limitation [19.pre]. EX1002, ¶102. Walton/802.11a/Hamabe includes a [blue] access point 104 (the "first node") "and two [green, red] terminals" 106a and 106n in the form of 802.11 stations (the "second" and "third" "nodes") "within system 100" (the "radio communications network"). EX1007, [0076], FIG. 2A; EX1002, ¶102.

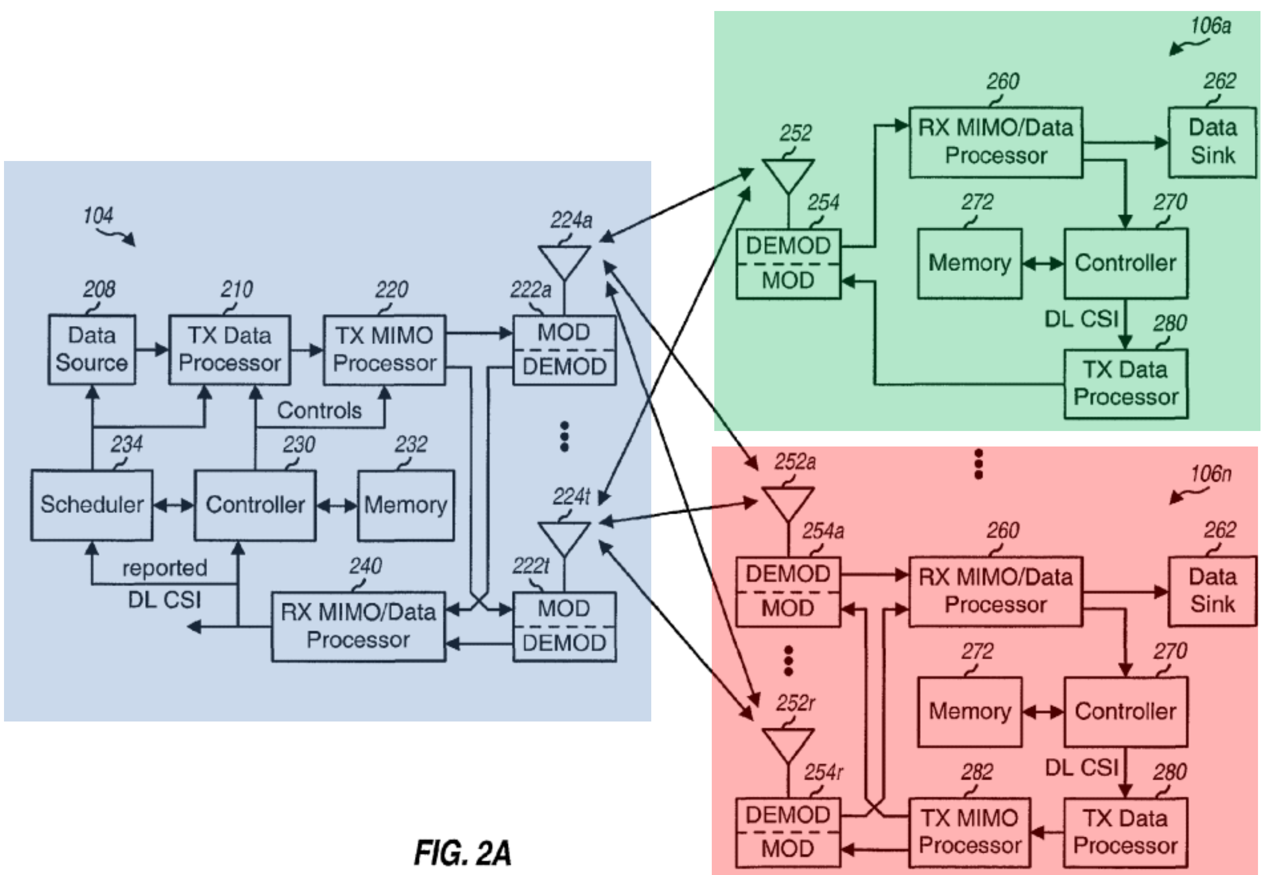

FIG. 2A

EX1007, FIG. 2A (annotated).

Walton describes MIMO techniques for "a wireless communication system." EX1007, [0010], FIG. 1. Walton's CSI and related preconditioning reduces co-channel interference (EX1007, [0090]-[0093]) and Hamabe's "carrier frequency interference avoiding method," implemented to "avoid co-channel operation" (EX1008, [0126]-[0127], EX1018, 3/3; EX1017, 1/17; EX1013, 6/7; *see also* EX1002, ¶¶73-75), avoids interfering signals. EX1002, ¶103. Thus, each aspect constitutes a method for managing interference in a radio communications network. *Id.*; EX1007, [0010], [0012]-[0013], [0090]-[0093], FIGs. 1, 2A, 4E; EX1008, [0002], [0020], [0125]-[0131].

[19.1]

Walton/802.11a/Hamabe renders obvious Limitation [19.1]. EX1002, ¶104. As discussed in Section IX.A.5, in Walton/802.11a/Hamabe if terminal 106a "determines that the carrier frequency must be changed," it "transmits the control information to" access point 104 that "contain[s] the results of this determination." EX1008, [0127], [0119], [0124]. Access point 104 in response "begins the process of changing the carrier frequency." *Id.* That is, access point 104 (the "first node") receives "control information" transmitted from terminal 106a (the "second node") indicating the current 802.11 channel "must be changed." *Id.*, [0127]; EX1002, ¶104. An indication that the current 802.11 channel "must be changed" instructs access point 104 to select a different 802.11 channel than the current channel, having a different center frequency. EX1009, 34-35/90; EX1002, ¶104. As Hamabe explains, upon receipt of this "control information," access point 104 "begins the process of changing" the 802.11 channel in use, confirming that the "control information is "an instruction" "to avoid using" the current channel "to transmit to the second node." EX1008, [1024]; EX1002, ¶104.

PO's infringement allegations assert that an instruction to not use "at least one secondary channel" (a continuous 20, 40, or 80 MHz OFDM channel) constitutes an instruction "to avoid using a plurality of frequencies." EX1010, 30-31/426. Walton/802.11a/Hamabe's instruction that the current 802.11 channel (containing a plurality of frequencies) "must be changed" and, therefore, should be avoided, meets this element in the same way as PO's infringement mapping.[7] EX1002, ¶105.[8]

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[7] Petitioner does not concede that PO's infringement mapping is correct but, as shown in this Petition, all Challenged Claims are obvious under PO's interpretation.

[8] To the extent a different 802.11 channel is selected that partially overlaps with the current channel, the non-overlapping frequencies constitute the plurality of frequencies to be avoided. EX1002, ¶105, n.5.

[19.2]

Walton/802.11a/Hamabe renders obvious Limitation [19.2]. EX1002, ¶106. As explained in Limitation [19.1], in response to receiving "control information," access point 104 "begins the process of changing" the 802.11 channel in use to a different 802.11 channel. EX1008, [1024]; EX1002, ¶106. After selecting the different 802.11 channel, access point 104 would make subsequent transmissions, including to terminal 106a, on that different 802.11 channel, observing 802.11a's standard channelization (EX1009, 11, 34-36/90) and "PPDU encoding process," "time windowing," and "spectral mask" requirements (*id.*, 15-19, 37/90). EX1002, ¶106.

In accordance with the standard, access point 104 will generate and "[u]p-convert the resulting 'complex baseband' waveform to an RF frequency according to the center frequency of the desired channel and transmit." EX1009, 15-16, 33/90. Where the "desired channel" is the different channel, the generated signal will not contain the "plurality of frequencies to be avoided" from the prior channel because each channel uses different frequencies. EX1002, ¶107; EX1009, 33-35/90. Further, 802.11a requires that the "transmitted spectral density of the transmitted signal shall fall within the spectral mask defined by the channel carrier frequency, f_c, of the desired channel, further confirming the signal does not include the plurality of frequencies to be avoided. EX1002, ¶107; EX1009, 33-37/90.

PO's infringement allegations assert that this standard process is sufficient to meet this limitation because filtering is allegedly "accomplished via a mask PPDU and resulting data scrambling." EX1010, 48/426. Walton/802.11a/Hamabe's use of 802.11a's standard channelization including the spectral "mask" meets this element in the same way as PO's infringement mapping. EX1002, ¶108.

Further, while 802.11a does not require a particular implementation of the spectral mask to comply with the standard, it would have been obvious to a POSITA to implement a number of filtering processes to ensure transmit mask compliance. EX1002, ¶109. These include OFDM time domain windowing, intermediate frequency filtering during up-conversion, digital-to-analog converter filtering to reduce noise, and bandpass filtering following up-conversion. *Id.*; *see e.g.,* EX1009, 18-19/90 (OFDM time domain windowing), EX1029, 1:53-2:16, FIG. 2 (intermediate frequency filtering), EX1029, 3:20-40, FIG. 3 (digital-to-analog converter filtering), EX1030, 25:43-63, FIG. 26A (bandpass filtering).

[19.3]

Walton/802.11a/Hamabe renders obvious Limitation [19.3]. EX1002, ¶110. The conclusion of the process described in Limitation [19.2] is for access point 104 to "[u]p-convert the resulting 'complex baseband' waveform to an RF frequency according to the center frequency of the desired channel ***and transmit***" to the target station, including station 106a (the "second node") the "filtered transmission signal" generated in Limitation [19.2]. EX1009, 15-16, 33/90; *see also* EX1007, FIG. 2A, [0048] ("System 100 may be operated to transmit data via a number of 'transmission' channels"); EX1002, ¶110.

[19.4]

Walton/802.11a/Hamabe renders obvious Limitation [19.4]. EX1002, ¶111. Walton discloses at "***each*** terminal 106 for which a data transmission is directed" from access point 104 "estimat[ing] the conditions of the downlink and provid[ing] channel state information (CSI) (e.g., post-processed SNRs or channel gain estimates) indicative of the estimated link conditions" and "transmit[ting] the downlink CSI back to [access point] 104 via a reverse channel." EX1007, [0080]-[0081], [0326]-[0327], FIG. 2A.

As shown in Walton's FIG. 2A (inset below), "[a]t ***each*** active terminal," "[yellow] RX MIMO/data processor 260 [] estimates the conditions of the downlink and provides channel state information (CSI) … indicative of the estimated link conditions," "[red] TX data processor 280 [] receives and processes the [purple] downlink CSI, and provides processed data indicative of the downlink CSI (directly or via [red] TX MIMO processor 282) to one or more modulators 254" that "transmit the downlink CSI back" to access point 104." EX1007, [0080], FIG. 2A. At access point 104, " the transmitted feedback signal is received by antennas 224, demodulated by demodulators 222, and provided to [blue] RX MIMO/data processor 240." EX1007, [0081], FIG. 2A.

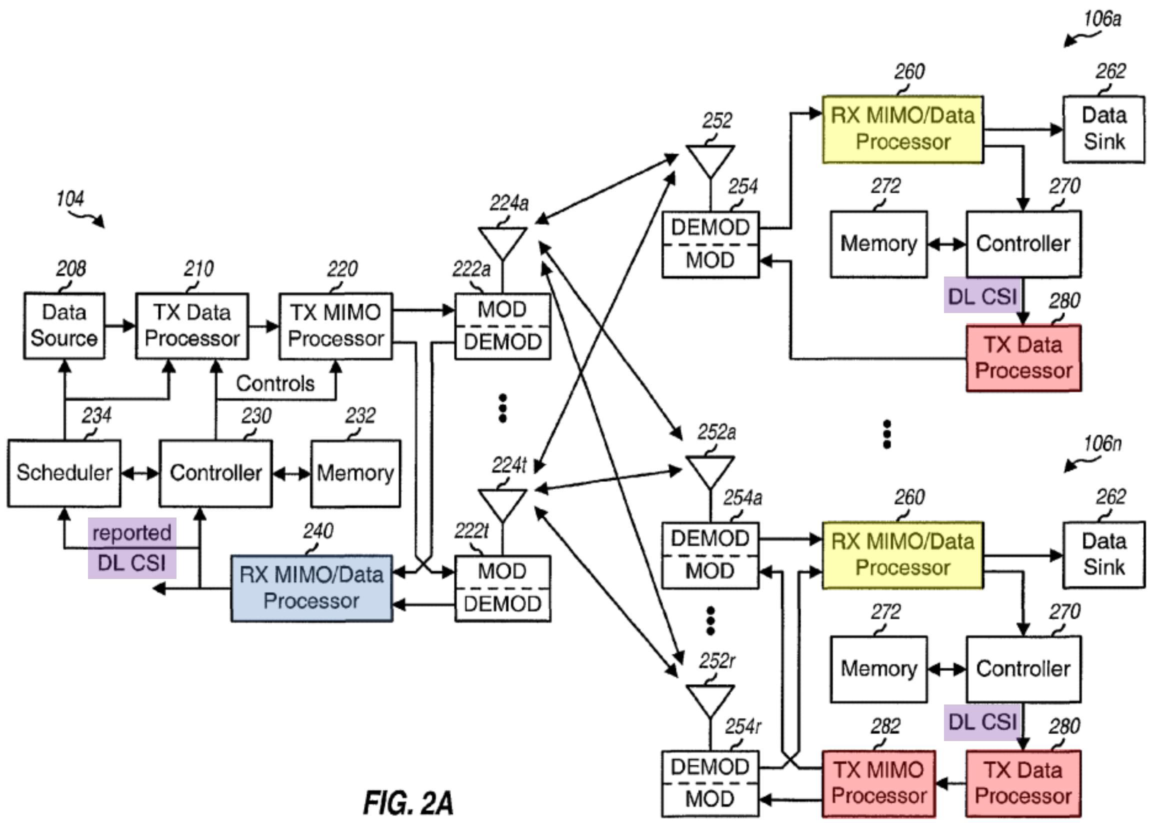

FIG. 2A

Id., FIG. 2A (annotated).

Thus, access point 104 receives first/second feedback from terminals 106a/106n (the "second"/"third" "nodes") of a first/second signal transmitted from access point 104 to terminals 106a/106n. EX1002, ¶113.

Walton's CSI feedback signal is "separate" from the "instruction" because the two are different signals used for different purposes. EX1002, ¶114.

Walton explains that this first/second feedback may be compressed. EX1007, [0323]; EX1002, ¶115. For example, "correlation in the frequency domain may be exploited to permit reduction in the amount of CSI to be fed back" by reporting a shared CSI element for a range of frequencies, rather than for each frequency individually. *Id.* "Other compression and feedback channel error recovery techniques to reduce the amount of data to be fed back for CSI may also be used and are within the scope of the invention." *Id.* Walton contains substantially more disclosure than the '720 Patent includes regarding compression. *Compare to* EX1001, 22:17-19, FIG. 14.

The CSI is based on a received power of the first/second signal at least because it includes "information that is indicative of, or equivalent to, SNR" for each transmission channel, which is the ratio between the received signal's power and the noise power for that transmission channel. EX1002, ¶116; EX1007, [0312], [0093], [0326]. The CSI is also based on one or more frequencies of a first/second signal because the CSI is derived for each transmission channel (i.e., each spatial subchannel of each frequency subchannel) of the first/second signal. EX1002, ¶116; EX1007, [0325].

[19.5]

See Limitation [19.4].

[19.6]

Walton/802.11a/Hamabe renders obvious Limitation [19.6]. EX1002, ¶118. At access point 104, "RX MIMO/data processor 240" "performs processing ***complementary*** to that performed by TX data processor 280 and TX MIMO processor 282" to "recover[] the reported CSI." EX1007, [0081], FIG. 2A. Where original CSI processing included compressing the CSI (*id.*, [0323]), the "complementary" processing necessarily includes decompressing the feedback. EX1002, ¶118. Further, a POSITA would understand that decompressing feedback is necessary to utilize the CSI to perform MIMO preconditioning as discussed with respect to Walton in Limitations [19.8]-[19.10] below. *Id.*

[19.7]

See Limitation [19.6].

[19.8]

Walton/802.11a/Hamabe renders obvious Limitation [19.8]. EX1002, ¶120. Walton discloses multiple embodiments in which a MIMO Transmitter Unit of access point 104, which includes TX Data Processor 210 and TX MIMO Processor 220, generates one or more data structures based on the (decompressed) CSI received from terminals 106a and 106n in order to generate a multi-user MIMO waveform for transmission. EX1007, [0104]-[0128], FIGs. 3B-3C; EX1002, ¶120.

In the FIG. 3C embodiment, "[red] channel MIMO processor 322" performs "full-CSI processing" "to generate N_T preconditioned modulation symbols" (vector x) by multiplying the "modulation symbols" vector, b, by the "eigenvector matrix E" of the MIMO channel, as shown in equation 5. EX1007, [0117]-[0122].

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_{N_T} \end{bmatrix} = \begin{bmatrix} e_{11}, & e_{12}, & e_{1N_C} \\ e_{21}, & e_{22}, & e_{2N_C} \\ e_{N_T1}, & e_{N_T2}, & e_{N_TN_C} \end{bmatrix} \cdot \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_{N_C} \end{bmatrix} \qquad \text{Eq (5)}$$

Id. As shown in FIG. 3C, the [purple] CSI is an input to "[red] channel MIMO processor 322."

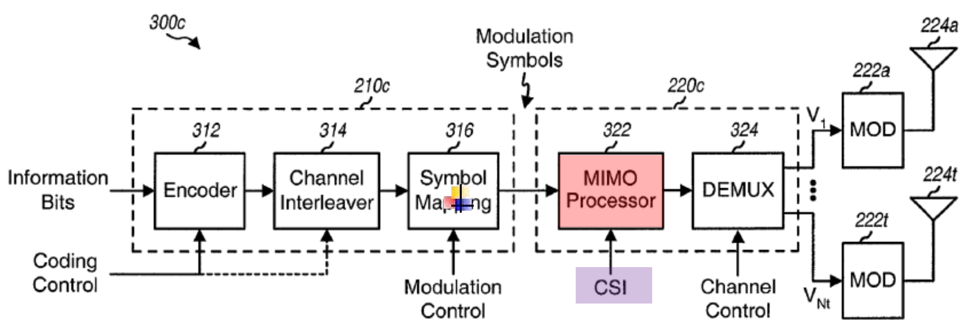

FIG. 3C

Id., FIG. 3C. Confirming channel transmitter unit MIMO processor 322 uses the received CSI, Walton explains: "The eigenvector matrix E ***may be computed*** by the transmitter unit or is provided to the transmitter unit (e.g., by the receiver unit)." *Id.* [0122]. A POSITA would understand that "computing" the eigenvector matrix E, which is "related to the transmission characteristics from the transmit antennas to the receive antennas," requires using the CSI received from terminals 106a and 106n (and decompressed) to determine the transmission characteristics from the transmit antennas of access point 104 to the receive antennas of terminals 106a and 106n. EX1002, ¶121. Accordingly, "eigenvector matrix E" and vector x of "N_T preconditioned modulation symbols," which is derived from eigenvector matrix E, are both one or more data structures based on the decompressed first feedback and the decompressed second feedback. *Id.*

In the FIG. 3B embodiment, "transmitter unit 300b includes a TX data processor 210b" that "further includes a symbol weighting element 318 that weighs the modulation symbols for each selected transmission channel based on a respective weight to provide weighted modulation symbols" such that "the modulation symbols for each selected transmission channel (j,k) may be weighted by a weight W(j,k) that is related to that channel's SNR" and calculated as shown in equation 3.

$$W(j,k) = \sqrt{\frac{\beta}{\gamma(j,k)}} \,. \qquad \text{Eq (3)}$$

EX1007, [0114], [0110]. In equation 3, γ(j, k) includes "the ***received*** SNR [] for transmission channel (j, k)," which is "the j-th spatial subchannel of the k-th frequency subchannel." *Id.*, [0106]-[0107]. The weight matrix W(j, k) is thus a data structure based on the CSI received from terminals 106a and 106n (where those terminals report SNR for different spatial subchannels) and decompressed. EX1002, ¶122.

[19.9]

Walton/802.11a/Hamabe renders obvious Limitation [19.9]. EX1002, ¶123. Access point 104 supports "[s]patial multiplexing, multi-user (multi-user MIMO mode)—the use of multiple transmit and receive antennas to accommodate communication with multiple terminals concurrently on the same channel" and "[m]ixed mode—the use of multiple transmit and receive antennas to accommodate communication with a combination of SIMO and MIMO terminals concurrently on the same channel." EX1007, [0065]-[0066]. "Scheduler 234" in access point 104 "uses the reported downlink CSI to perform a number of functions such as (1) selecting the best ***set of*** terminals for data transmission and (2) assigning the available transmit antennas to the selected terminals." EX1007, [0082], [0071] ("multiple transmit antennas at the base station may be used to send data to different terminals using parallel transmission channels"). The scheduler can also allocate available "frequency subchannels." *Id.*, [0385] ("the scheduler can find combinations of 'mutually compatible' terminals for simultaneous data transmission on the allocated channels … by exploiting the 'spatial signatures' (and possibly the frequency signatures)"); *see also id.*, [0049]-[0054] ("The following channels and subchannels may be supported by the system: … transmission channel—a spatial subchannel, a ***frequency subchannel***, or a spatial subchannel of a ***frequency subchannel*** over which an independent data stream may be transmitted"), [0076] ("the coded bits are transmitted over multiple frequency subchannels"), [0130]-[0131] ("the modulation symbols may be transmitted on multiple frequency subchannels and from multiple transmit antennas"); EX1002, ¶123.

Accordingly, access point 104 may transmit to multiple terminals simultaneously on the same OFDM channel by employing multiple antennas and frequency subchannels. EX1002, ¶124. That is, access point 104 may simultaneously transmit a filtered first transmission signal to terminal 106a and a second filtered transmission signal to terminal 106n with each signal transmitted via one or more antennas of access point 104's multiple antennas and using one or more frequency subchannels of the OFDM channel. *Id.*; EX1007, [0065]-[0066], [0071], [0082], [0385], [0049]-[0054], [0076], [0130]-[0131], FIGs. 2A, 3B-3E.

Each signal is "filtered" for the reasons discussed in Limitations [19.2]-[19.3].

Each signal is transmitted using 802.11a's "OFDM PHY" layer (EX1009, 15-16, 32/90), as modified by Walton. Section IX.A.5; EX1002, ¶126. This modified 802.11a protocol is significantly closer to the 802.11a and 802.11g protocols that were known and the ’720 Patent references (EX1001, 19:42-45) than the unknown at the ECPD 802.11ac protocol that PO accuses in the Litigation. EX1010, 1/426.

The filtered first/second transmission signals use a first/second frequency for at least two reasons. EX1002, ¶127. First, as discussed above, in scheduling simultaneous MIMO transmissions to multiple terminals, access point 104 may assign certain frequency subchannels, including a first frequency, to the first transmission signal and certain frequency subchannels, including a second frequency, to the second transmission signal. *Id.*; EX1007, [0385], [0049]-[0054], [0076], [0130]-[0131]. Second, even if the filtered first/second transmission signals are transmitted with the same set of frequency subchannels, each will be transmitted using multiple frequency subchannels (“a frequency bin in an OFDM system,” EX1007, [0054]), such that a first frequency subchannel in the set may be the “first frequency” and a second frequency subchannel in the set may be the “second frequency.” EX1002, ¶127.

The filtered first/second transmission signals use a first/second power that is based on at least one of the one or more data structures. EX1002, ¶128. PO’s infringement allegations assert that a transmission signal uses a first/second power that is based on at least one of the one or more data structures by applying “one or more respective steering matrices” in a MIMO system. EX1010, 66, 71/426. PO’s interpretation of this element is met by Walton’s FIG. 3C embodiment in which a transmission signal is generated by applying the "eigenvector matrix, E." EX1007, [0117]-[0122]; Limitation [19.8]; EX1002, ¶128. A POSITA would understand that this "eigenvector matrix, E," is a steering matrix that preconditions the independent data streams to steer each through the MIMO channel. EX1002, ¶128.

Walton's FIG. 3B embodiment also meets this requirement because the power of the filtered first/second transmission signals are generated using the weights matrix, W(j,k). EX1007, [0104]-[0114]; Limitation [19.8]; EX1002, ¶129.

Further, Walton's FIG. 3E embodiment employs both the weights matrix, W(j,k), and the eigenvector matrix, E, to process each data stream using the data processor 210b of FIG. 3B and "a MIMO processor followed by a demultiplexer" as "shown in FIG. 3C." EX1007, [0130]-[0131], FIGs. 3B, 3C, 3E.

[19.10]

See Limitation [19.9].

b. Claim 22

[22.1]

Walton/802.11a/Hamabe renders obvious Limitation [22.1]. EX1002, ¶132. The instruction from terminal 106a in Limitation [19.1] is a "first instruction."

[22.2]

Walton/802.11a/Hamabe renders obvious Limitation [22.2]. EX1002, ¶133. As described in Limitations [19.1]-[19.2], access point 104 (the "first node") receives "control information" transmitted from terminal 106a (the "second node") indicating the current 802.11 channel "must be changed," which results in access point 104 changing from a first to a second 802.11 channel. EX1008, [0127]. As explained in Section IX.A.5, a POSITA would apply Hamabe's method to each of terminals 106. EX1002, ¶133. Accordingly, access point 104 (the "first node") also receives "control information" (a "second instruction") transmitted from terminal 106n (the "third node") indicating the current 802.11 channel "must be changed." EX1008, [0127]; EX1002, ¶133. Subsequent to access point 104 changing from a first to a second 802.11a channel in response to the first instruction, terminal 106n may make a determination and send an instruction to access point 104 indicating that the second 802.11a channel "must be changed," constituting an instruction "to avoid using a ***different*** plurality of frequencies" (the frequencies of the second 802.11a channel) to transmit to the third node" for the reasons discussed for Limitation [19.1]. EX1002, ¶133.

[22.3]

Walton/802.11a/Hamabe renders obvious Limitation [22.3]. EX1002, ¶134. As discussed for Limitation [19.2], in response to an instruction to change from a second 802.11a channel to a third 802.11a channel, access point 104 will perform standard processing to generate and transmit a signal on the third channel, that signal not including the "plurality of frequencies to be avoided" of the second 802.11a channel. Section IX.A.5; EX1008, [0127], [0119], [0124]; EX1009, 34-35/90; EX1002, ¶134.

c. Claim 23

[23.1]

Walton/802.11a/Hamabe renders obvious Limitation [23.1] for reasons discussed in Limitations [19.9] and [19.10]. EX1002, ¶¶135-136. Specifically, at least in the FIGs. 3B and 3E embodiments, Walton allocates the same transmit power to transmission channels with the same SNR at the receiver. EX1007, [0110]-[0111], Eq (4). A POSITA would have understood that terminals 106a and 106n may periodically experience the same SNR on their respective transmission channels, for example, because they are located a similar distance from access point 104 in a low-interference environment. EX1002, ¶135. Thus, it was obvious that the first power and second power may be the same. *Id.*

d. Claim 24

[24.1]

Walton/802.11a/Hamabe renders obvious Limitation [24.1] for reasons discussed in Limitations [19.9], [19.10], and [23.1]. *Id.*, ¶137. Specifically, at least in the FIGs. 3B and 3E embodiments, Walton allocates different transmit power to transmission channels with different SNRs at the receiver. EX1007, [0110]-[0111], Eq (4). A POSITA would have understood that the measured SNRs may be different. EX1002, ¶137. Thus, it was obvious that the first power and second power may be different. *Id.*

e. Claim 25

[25.1]

Walton/802.11a/Hamabe renders obvious Limitation [25.1] for reasons discussed in Limitations [19.4], [19.5], [19.9], and [19.10]. EX1002, ¶138. Walton teaches that "differential updates to the full CSI characterization may be sent periodically, when the channel changes by some amount." EX1007, [0314]; *see also id.*, [0323]. The fed back CSI, including the differential updates, may be used to implement "adaptive processing" to "improve utilization of the MIMO channel." *Id.*, [0325]-[0328]. While Walton does not provide a timescale on which the channel might change and CSI updates are sent, a POSITA would have understood that this time period is much less than one second, even for a person walking while holding a mobile device. EX1002, ¶¶138-139; *see* EX1022, 36:5-15 (deriving a MIMO channel stability time of 7.5 milliseconds for a remote station moving at 1 meter per second); EX1042, 1/17 (finding that the mean "usual" walking speed is approximately 1.31 meters per second). Therefore, a POSITA would have understood that Walton's teaching to send CSI updates when the channel changes and update the system's CSI processing accordingly is repeatedly receiving an update of both the first and second compressed feedbacks at time periods of less than one second and updating the first and second powers at time periods of less than one second based on the respective feedback, via the processes described with respect to Limitations [19.9] and [19.10]. EX1002, ¶140.

f. Claim 26

[26.1]

Walton/802.11a/Hamabe renders obvious Limitation [26.1]. EX1002, ¶141. Each of Walton's FIG. 3B and 3C embodiments discussed above illustrate a "transmitter unit" in which a ***single*** series of components perform processing "for ***each*** selected transmission channel" and, thus, the filtered first/second transmission signals are transmitted via the same transceiver. EX1007, FIG. 3B-3C, [0114], [0116]-[0117]; EX1002, ¶141.

g. Claim 27

[27.1]

Walton/802.11a/Hamabe renders obvious Limitation [27.1]. EX1002, ¶142. In Walton's FIG. 3E embodiment discussed in Limitation [19.9] "the stream of information bits for ***each*** frequency subchannel used for data transmission is provided to a ***respective*** frequency subchannel data processor 330" and "the up to NC modulation symbol streams from each data processor 330 are provided to a ***respective*** spatial processor 332" and each transmit antenna has "a ***respective*** modulator 222." EX1007, [0130]-[0132]. Walton also teaches to "***assign*** the available transmit antennas to the selected terminals" for transmission. *Id.*, [0466],

[0476]-[0494]. Ultimately, the system transmits using "the specific set of terminals scheduled for data transmission in the upcoming transmission interval and ***their assigned transmit antennas.***" *Id.*, [0482]. Thus, each terminal may have a respective spatial processor, frequency subchannel, and transmit antenna for any particular transmission interval. EX1002, ¶142.

As shown in FIG. 3E, this results in multiple different transceivers, one for each frequency subchannel/antenna combination.

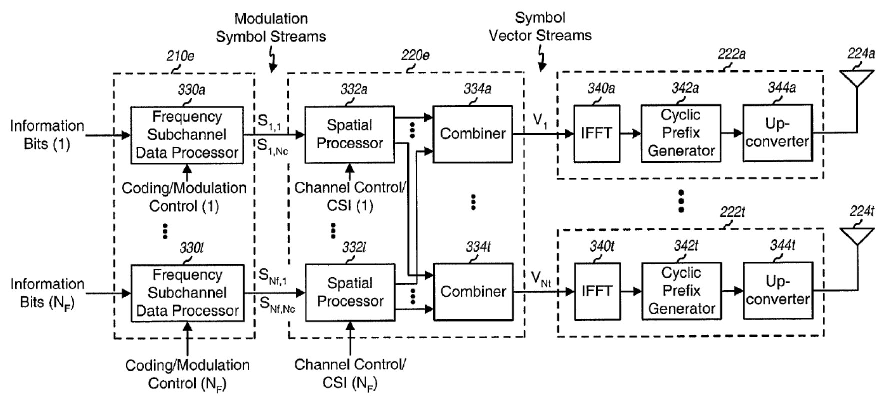

FIG. 3E

Id., FIG. 3E; EX1002, ¶143. Accordingly, at least where the filtered first/second transmission signals are divided by frequency subchannel and transmit antenna, they are transmitted via different transceivers. EX1002, ¶143.

In addition, it would also have been obvious to a POSITA to design access point 104 such that it includes different transceivers for different sectors (i.e., directions from the access point 104). While Walton does not provide hardware implementation details for its MIMO transceiver(s), it was known in the art that directional antennas may be used to transmit independent data streams to terminals located in different sectors around the access point. *See* EX1002, ¶144 (citing EX1022, 11:1-26, FIG. 8). For example, three antennas may be arranged to each cover a 120 degree sector. EX1002, ¶144. Then, the access point transmits to each terminal using the antenna for the sector in which the ideal paths to the terminal lie. *Id.* Using this transceiver configuration, there will be circumstances under which the ideal path to transmit to the first terminal ("second node") lies in one antenna's sector, while the path for the second terminal ("third node") lies in a different antenna's sector. In this case, the access point 104 would use different transceivers to transmit to each terminal, or node. *Id.*

Alternatively, it would also have been obvious to a POSITA to design access point 104 such that it contained two separate transceivers operating in different channels in the 5 GHz band. It was known in the art that dual-band 802.11 access points with multiple transceivers can increase system capacity (i.e., bandwidth) by allowing simultaneous communication in different 802.11 channels. EX1002, ¶145; *see e.g.,* EX1038, 3-4/4. Considering that the 802.11a 5 GHz band was already divided into upper and lower sets of channels, a POSITA would have considered it obvious to implement Walton/802.11a/Hamabe as a multiple transceiver system with one transceiver operating on an 802.11 channel in the lower set of 5 GHz channels and one transceiver operating on an 802.11 channel in the upper set.

EX1002, ¶145; *see* EX1009, 34-35/90. This would effectively double the available bandwidth of access point 104, improving data rates and downlink communication speed, all desirable features of wireless networks. EX1002, ¶145.

h. Claim 28

[28.1]

Walton/802.11a/Hamabe renders this Limitation obvious for reasons discussed in Section IX.A.5. EX1002, ¶146. PO's infringement allegations assert that a "MIMO Control field" MAC frame field constitutes receiving the instruction "utilizing a dedicated channel." EX1010, 103-104/426. As discussed in Section IX.A.5, it would have been obvious to include the instruction in a MAC frame field, such as one included in a RTS or CTS message, meeting PO's interpretation. Therefore, Walton/802.11a/Hamabe meets this element in the same way as PO's infringement mapping. EX1002, ¶146.

i. Claim 29

[29.1]

Walton/802.11a/Hamabe renders obvious Limitation [29.1]. EX1002, ¶147. A POSITA would have understood that the antennas disclosed in Walton, Hamabe, and 802.11a may be antennas configured for omnidirectional communication because antennas with omnidirectional antenna patterns were well known in the art of antenna design and it was known to use them in beamforming applications. EX1002, ¶147; *see e.g.,* EX1022, 8:19-20 ("Antennas 16, 18 are diversity antennas that cover overlaid sectors or are omnidirectional.”), FIG. 4; EX1023, 3:31-36. An omnidirectional radiation pattern is important in many applications because “the signal received from the base station can arrive at any principal angle relative to the orientation of the terminal.” EX1023, 3:36-39. This is similarly true of the signals received at the base station/access point from the terminals. EX1002, ¶147. Therefore, a POSITA would have understood that the antennas disclosed in Walton that receive the instruction from the first terminal are configured for omnidirectional communication. *Id.*; *see* EX1007, FIG. 2A.

j. Claim 30

[30.1]

Walton/802.11a/Hamabe renders obvious Limitation [30.1] for reasons similar to those discussed in Section IX.A.5 and Limitation [28.1]. EX1002, ¶148. PO’s infringement allegations assert that a “MIMO Control field” MAC frame field constitutes receiving the compressed first and second feedbacks “utilizing a dedicated channel.” EX1010, 105-106/426. As discussed in Section IX.A.5, it would be obvious to include the CSI feedback in a MAC frame, such as a MAC management frame, which were known as vehicles to carry larger payloads of data related to network management, meeting PO’s interpretation. EX1002, ¶148. Therefore, Walton/802.11a/Hamabe meets this element in the same way as PO’s infringement mapping. *Id.*

k. Claim 31

[31.1]

Walton/802.11a/Hamabe renders obvious Limitation [31.1] for reasons discussed in Limitations [29.1]. EX1002, ¶149. Specifically, the compressed first feedback and compressed second feedback are received at the same antennas as the interference avoidance determinations (instructions). *See* EX1007, FIG. 2A; [0327] ("At [access point] 104, the transmitted feedback signal is received by antennas 224"); EX1002, ¶149.

l. Claim 32

[32.1]

Walton/802.11a/Hamabe renders obvious Limitation [32.1]. EX1002, ¶150. Walton's full CSI is used to precondition each data stream so that the data streams are separable at the receiver. EX1007, [0157] ("the spatial and space-time receiver processing techniques attempt to separate out the transmitted signals at the receiver unit"), [0268] ("greater signal separation may be possible if the transmitted signals are less correlated"). Achieving spatially separable data streams is a fundamental goal of MIMO. EX1002, ¶150 (citing EX1023, 41:18, 43:10-12). It is the MIMO preconditioning that creates spatial channels that can be distinguished at the receiver. EX1002, ¶¶150-152; EX1007, [0163] ("The ability to effectively null undesired signals or optimize the SNRs depends upon the correlation in the channel coefficient matrix H that describes the channel response between the transmit and receive antennas."). Thus, the CSI received by the access point from the terminals are a decompressed first feedback and a decompressed second feedback that are used to increase spatial separation among transmissions. EX1002, ¶151; *see also* EX1007 [0157], [0268].

m. Claim 33

[33.1]

Walton/802.11a/Hamabe renders obvious Limitation [33.1] for reasons discussed in Limitation [32.1]. EX1002, ¶153. In Walton's MIMO OFDM mode, there is "one data substream for each spatial subchannel selected for use for the [OFDM] frequency subchannel." EX1007, [0130]. As explained in Limitation [32.1], preconditioning increases spatial separation among these data substreams, or transmission channels, which are transmissions at the same frequency. EX1002, ¶153; *see also* EX1007, [0157], [0268].

n. Claim 36

[36.1]

Walton/802.11a/Hamabe renders obvious Limitation [36.1] for reasons discussed in Limitation [19.4]. EX1002, ¶154. Specifically, the CSI includes "information that is indicative of, or equivalent to, SNR" for each transmission channel (i.e., each spatial subchannel of each frequency subchannel), which is the ratio between the received signal's power and the noise power for that transmission channel. EX1002, ¶154; EX1007, [0312], [0093], [0325]-[0326]. Thus, the CSI is based on a received power at a plurality of frequencies via which the first signal is received. EX1002, ¶155.

o. Claim 37

[37.1]

Walton/802.11a/Hamabe renders obvious Limitation [37.1]. EX1002, ¶156. Both the Walton CSI feedback and Hamabe interference avoidance algorithms are ongoing processes, with both CSI and interference avoidance determinations being transmitted to the access point periodically, as needed. *See* EX1007, [0323] ("full or partial CSI is reported periodically"); EX1008, [0130]-[0131]. Therefore, a POSITA would have understood that an interference avoidance determination may be received prior to the receipt of any particular instance of CSI. EX1002, ¶156.

p. Claim 38

[38.1]

Walton/802.11a/Hamabe renders obvious Limitation [38.1]. EX1002, ¶157. As discussed for Limitations [19.9], Walton discloses scheduling of different users based on "a spatial subchannel, a ***frequency subchannel***, or a spatial subchannel of a frequency subchannel." EX1007, [0049]-[0054]. Where the filtered first/second transmission signals are separated based on frequency, but scheduled on the same antennas, they are sent "via the same plurality of antennas." EX1002, ¶157; *see also* EX1007, [0065]-[0066], FIGs. 2A, 3E.

q. Claim 39

[39.1]

Walton/802.11a/Hamabe renders obvious Limitation [39.1]. EX1002, ¶158. In Walton's selective channel inversion method, "only transmission channels for which the received SNR is greater than or equal to the SNR threshold … are selected for use." EX1007, [0112], Eq (4).

$$P_{tx}(j,k) = \begin{cases} \dfrac{\beta P_{tx}}{\gamma(j,k)}, \text{ for } \gamma(j,k) \geq \gamma_{th}. \\ 0, \text{ otherwise} \end{cases} \qquad \text{Eq (4)}$$

Id., Eq (4). Walton discloses that SNR is provided as part of the CSI fed back from each terminal. *Id.*, [0312]. Therefore, when transmission channels are "selected for use" for each terminal based on the SNR fed back as part of the CSI from each terminal, the first frequency is selected as a function of the compressed first feedback, and the second frequency is selected as a function of the compressed second feedback. EX1002, ¶159.

r. Claim 40

[40.1]

Walton/802.11a/Hamabe renders obvious Limitation [40.1]. EX1002, ¶159. As discussed in Section IX.A.5, it would have been obvious to include a form of

CTS/RTS frames that enabled the mobile station "to notify that the condition for changing the carrier frequency has been satisfied." EX1002, ¶159; EX1008, [0127]; EX1025, 49-58/528.

s. Claim 41

[41.1]

See Limitation [40.1].

t. Claim 42

[42.1]

Walton/802.11a/Hamabe renders obvious Limitation [42.1]. EX1002, ¶161. As discussed for Limitations [19.9], Walton discloses scheduling of different users based on "a ***spatial subchannel***, a frequency subchannel, or a ***spatial*** subchannel of a frequency subchannel." EX1007, [0049]-[0054]. Where the filtered first/second transmission signals are separated based on spatial subchannels by sending on separate antennas, they are sent via at least one different antenna." EX1002, ¶161; *see also* EX1007, [0065]-[0066], FIGs. 2A, 3E.

u. Claim 43

[43.1]

Walton/802.11a/Hamabe renders obvious Limitation [43.1]. EX1002, ¶162. As discussed for Limitations [19.9], Walton discloses scheduling of different users based on "a spatial subchannel, a ***frequency subchannel***, or a spatial subchannel of a frequency subchannel." EX1007, [0049]-[0054]. Where the filtered first/second transmission signals are separated based on frequency, but scheduled on the same antennas, they are sent "using the at least one antenna." EX1002, ¶162; *see also* EX1007, [0065]-[0066], FIGs. 2A, 3E.

v. Claim 45

[45.1]

Walton/802.11a/Hamabe renders obvious Limitation [45.1] for reasons discussed in Limitation [19.2]. EX1002, ¶163. Specifically, when Walton/802.11a/Hamabe's access point 104 switches into a new channel, the access point adjusts its processing to comply with the 802.11a spectral mask such that no power is used in the original 802.11a channel, where transmission power was previously used. *Id.*; *see* EX1009, 37/90. This is consistent with PO's infringement allegations, which assert that this Limitation is met by changing the frequency band to be used by the network such that the "plurality of frequencies to be avoided" are not used. EX1010, 141/426. Walton/802.11a/Hamabe's switching between 802.11a's channels meets this element in the same way as PO's infringement mapping. EX1002, ¶163.

w. Claim 46

[46.1]

Walton/802.11a/Hamabe renders obvious Limitation [45.1] for reasons discussed in Limitations [19.1], [19.2] and [45.1]. EX1002, ¶164. Hamabe's interference avoidance notification indicates that the access point must move the network's carrier frequency out of the current channel and into a channel not adjacent to the current channel. EX1002, ¶164. As there are a limited number of channels in the 802.11a 5 GHz band, a POSITA would have understood this as an instruction to use any of the only 9 other 802.11 OFDM channels in the 5 GHz band. *Id.*; *see* EX1009, 35/90. Alternatively, given the limited options and unique ability of each terminal to measure its local spectrum, it would have been obvious for a POSITA to explicitly include one or more of these 9 channels in the interference avoidance notification to streamline the channel switching process for the access point. EX1002, ¶164.

x. Claim 49

[49.1]

Walton/802.11a/Hamabe renders obvious Limitation [49.1]. EX1002, ¶165. Walton discloses an "[a]daptive reuse scheme" under which "system resources may be divided into sets of 'orthogonal' channels, which may then be assigned to the cells, one channel set per cell in a reuse cluster." EX1007, [0344]-[0345]. Each "channel" may be a "frequency band[] for an FDM-based scheme." *Id.*, [0341]. An intelligent reuse scheme "reduces or eliminates mutual interference caused by terminals within a reuse cluster" because "[t]he channels in the set allocated to any one cell in a reuse cluster are orthogonal to the channels in the other sets allocated to the other cells in the cluster." *Id.* For example, in a "3-cell reuse pattern," the available channels are grouped into three sets, and "each cell in a 3-cell cluster may be allocated one of the channel sets." *Id.*, [0342]. Then, "the reuse cluster is repeated throughout the network." *Id.*, [0333]. Walton uses the term "cell," but a POSITA would understand Walton's cells to be analogous to the basic service set (BSS) used in 802.11. EX1002, ¶165; *see also* EX1007, [0043] ("The base station and/or its coverage area are also often referred to as a 'cell'"). Based on this disclosure, a POSITA would have understood that the adaptive channel reuse scheme disclosed in Walton reuses frequency channels in order to increase spatial reuse across multiple basic service sets. EX1002, ¶165.

y. Claim 50

[50.1]

Walton/802.11a/Hamabe renders obvious Limitation [50.1] for reasons discussed in Section IX.A.5 and Limitation [49.1]. EX1002, ¶166. As explained in Section IX.A.5, it was known to include control information in MAC frames such as RTS and CTS frames. *Id.* It would be obvious to implement Walton's adaptive reuse scheme such that the control information required to instantiate and update the adaptive reuse scheme is sent in an additional field in a RTS or CTS message so that the RTS/CTS signaling is extended. *Id.*

z. Claim 51

[51.1]

Walton/802.11a/Hamabe renders obvious Limitation [50.1] for reasons discussed in Limitations [40.1] and [49.1]. EX1002, ¶168. To the extent that the intended use claim language, "to accommodate legacy access points" is deemed limiting, a POSITA would have understood that a purpose of frequency reuse schemes is to reduce the number of devices in a particular geographic area that are operating on the same frequency, which lowers the level of background noise on that frequency, thereby accommodating legacy access points operating on that frequency. *Id.*; *see also* EX1007, [0333] ("This strategy reduces or eliminates mutual interference caused by terminals within a reuse cluster.").

aa.Claim 52

[52.pre]

See Limitation [19.pre].

[52.1]

See Limitation [19.1].

[52.2]

See Limitation [19.2].

[52.3]

See Limitation [19.3].

[52.4]

See Limitations [19.1], [19.9].

[52.5]

See Limitation [22.2].

[52.6]

See Limitation [22.3].

[52.7]

See Limitations [19.10] and [22.3].

bb. Claim 53

[53.pre]

See Limitation [19.pre].

[53.1]

See Limitation [19.1].

[53.2]

See Limitation [19.2].

[53.3]

See Limitation [19.3].

[53.4]

Walton/802.11a/Hamabe renders obvious Limitation [53.4] for reasons discussed in Limitation [19.4]. EX1002, ¶¶181-183. Further, Walton's CSI is not only based on a received pilot signal, as described in Limitation [19.4], but also characterizes the receipt of that pilot signal because full CSI is the "channel coefficient matrix that gives the channel response for the N_T transmit antennas and N_R receive antennas at a specific time," that specific time being when the pilot signal is received and used to derive the CSI. *See* EX1007, [0174], [0077] ("full CSI (e.g., a channel response matrix H)"), FIG. 4E; EX1002, ¶181.

[53.5]

See Limitation [19.5] and [53.4].

[53.6]

See Limitation [19.6].

[53.7]

See Limitation [19.7].

[53.8]

Walton/802.11a/Hamabe renders obvious Limitation [53.8] for reasons discussed in Limitation [19.8] and [19.9]. EX1002, ¶187. Specifically, because the data structures described in Limitation [19.8] are themselves based on the decompressed first feedback, the first power that is based on the data structures—as described in Limitation [19.9]—is also based on the decompressed first feedback. *Id.*

[53.9]

Walton/802.11a/Hamabe renders obvious Limitation [53.9] for reasons discussed in Limitation [19.10]. EX1002, ¶188. Specifically, because the data structures described in Limitation [19.8] are themselves based on the decompressed second feedback, the second power that is based on the data structures—as described in Limitation [19.10]—is also based on the decompressed second feedback. *Id.*

cc. Claim 54

[54.1]

See Limitation [19.1].

[54.2]

See Limitation [22.2].

[54.3]

See Limitation [22.3].

dd. Claim 55

[55.1]

See Limitation [23.1].

ee. Claim 56

[56.1]

See Limitation [24.1].

ff. Claim 57

[57.1]

Walton/802.11a/Hamabe renders obvious Limitation [57.1] for reasons discussed in Limitations [19.8] and [19.9]. EX1002, ¶194. Specifically, the matrix, "W(j, k)" used to weight "the modulation symbols for each selected transmission channel (j, k)" is a first data structure that the first power is based on. EX1002, ¶194; *see* EX1007, [0110], Eq (3). Additionally, a POSITA would have understood that the matrix, W(j, k) must be unique for each receiving node in the network because it is based on the received SNRs, as shown in Eq (3), and the SNR for a transmission channel will be different at each receiving node, which may be located at different locations relative to the transmitter and experience different local noise profiles. EX1002, ¶194; *see* EX1007, Eq (3), [0106]-[0110].

[57.2]

Walton/802.11a/Hamabe renders obvious Limitation [57.2] for reasons discussed in Limitations [19.8], [19.10], and [57.1]. EX1002, ¶195. As explained in Limitation [57.1], a POSITA would have understood that the matrix of modulation symbol weights, W(j, k) must be unique to each receiving node because it is based on the unique set of SNRs for each receiving node. EX1002, ¶195; *see* EX1007, Eq (3), [0106]-[0110]. Therefore, a POSITA would have understood Walton to disclose both a first matrix of weights for transmission to the first terminal, as discussed in Limitation [57.1], and a second matrix of weights for transmission to the second terminal in the network. EX1002, ¶195.

gg.Claim 58

[58.1]

See Limitations [57.1] and [57.2].

hh. Claim 60

[60.1]

See Limitations [57.1] and [57.2].

ii. Claim 61

[61.1]

Walton/802.11a/Hamabe renders obvious Limitation [61.1] for reasons discussed in Limitations [57.1] and [57.2]. EX1002, ¶198. Specifically, a POSITA would have understood the respective weights matrices for transmission to each node as respective first and second profiles because each matrix is defined across each "j-th spatial subchannel of the k-th frequency subchannel." EX1002, ¶198; *see* EX1007, [0107]. Thus, the weights matrices represent the first and second weighting profile to be used to transmit modulation symbols to the second and third nodes, respectively. EX1002, ¶198.

jj. Claim 62

[62.1]

Walton/802.11a/Hamabe renders obvious Limitation [62.1] for reasons discussed in Limitations [57.1] and [61.1]. EX1002, ¶199. Walton teaches that the weight matrix, W(j, k) enables the transmitter "[t]o simplify the data processing at both the transmitter and receiver units" by using "a common coding and modulation scheme." EX1007, [0105]. To the extent that the phrase "optimal waveform profile" has a definite meaning, a POSITA would have understood that tailoring the transmission waveform to simplify the data processing required at the transmitter and receiver is one form of optimality. EX1002, ¶199. Thus, the weight matrix disclosed in Walton is a first data structure that is a first optimal waveform profile. EX1002, ¶199; *see* EX1007, [0105]-[0110].

kk. Claim 63

[63.1]

Walton/802.11a/Hamabe renders obvious Limitation [63.1] for reasons discussed in Limitations [19.8] and [19.10]. EX1002, ¶200. Specifically, the eigenvector matrix, E, is generated based on CSI from both the first and second terminals when the access point has scheduled a simultaneous MU-MIMO transmission to both terminals because it has a row for each receive antenna. *See* EX1007, [0117], [0065]-[0066], FIG. 2A. Under PO's interpretation of the claim language and its relation to MIMO preconditioning, the first power and the second power are based on this single data structure. *See* Limitation [19.9]; EX1010 65-76/426; EX1002, ¶200.

ll. Claim 64

[64.1]

See Limitation [38.1].

mm. Claim 65

[65.1]

See Limitation [42.1].

nn. Claim 66

[66.1]

See Limitation [43.1].

oo. Claim 67

[67.1]

See Limitation [25.1].

pp. Claim 68

[68.1]

Walton/802.11a/Hamabe renders obvious Limitation [68.1] for reasons discussed in Limitation [25.1]. EX1002, ¶206. To the extent that the phrase "in real-time" has a definite meaning, a POSITA would have understood it to be rendered obvious by Walton/802.11a/Hamabe's periodic CSI updates for the same reasons described in Limitation [25.1]. *Id.*

qq. Claim 69

[69.1]

See Limitation [25.1].

rr. Claim 70

[70.1]

See Limitation [26.1].

ss. Claim 71

[71.1]

See Limitation [27.1].

tt. Claim 72

[72.1]

See Limitation [30.1].

uu. Claim 73

[73.1]

See Limitation [31.1].

vv. Claim 74

[74.1]

See Limitation [32.1].

ww. Claim 75

[75.1]

See Limitation [33.1].

xx. Claim 77

[77.1]

See Limitation [19.4].

yy. Claim 78

[78.1]

See Limitation [36.1].

zz. Claim 79

[79.1]

Walton/802.11a/Hamabe renders obvious Limitation [79.1] for reasons discussed in Limitation [19.4]. EX1002, ¶216. Specifically, the CSI is based on a series of power values as a function of frequency at least because it includes "information that is indicative of, or equivalent to, SNR" for ***each*** transmission channel, which is the ratio between the received pilot signal's power and the noise power for that transmission channel. EX1002, ¶216; *see also* EX1007, [0312], [0093], [0326].

aaa. Claim 80

[80.1]

Walton/802.11a/Hamabe renders obvious Limitation [80.1] for reasons discussed in Limitations [19.4] and [79.1]. EX1002, ¶217. Further, Walton discloses that full CSI may "comprise[] eigenmodes plus any other information that is indicative of, or equivalent to, SNR." EX1007, [0312]. Thus, the CSI fed back to the access point that contains the eigenmodes and SNRs for each transmission channel is a data structure that is based on a series of power values as a function of frequency. EX1002, ¶217.

bbb. Claim 81

[81.1]

See Limitation [37.1].

ccc. Claim 82

[82.1]

See Limitation [19.4].

ddd. Claim 83

[83.1]

Walton/802.11a/Hamabe renders obvious Limitation [83.1] for reasons discussed in Limitations [19.9] and [19.10]. EX1002, ¶220. Further, Walton teaches that a base station/access point may communicate with at least three terminals (and up to N) using N_R receive antennas and multi-user MIMO mode. EX1007, [0044], [0046], [0066], FIGs. 1, 2A. Accordingly, Walton/802.11a/Hamabe renders obvious simultaneous transmission of a third transmission signal to a third device for the same reasons described in Limitations [19.9] and [19.10] with respect to a first and second device. EX1002, ¶220.

eee. Claim 84

[84.1]

See Limitations [42.1] and [83.1].

fff.Claim 85

[85.1]

See Limitation [41.1].

ggg. Claim 86

[86.1]

See Limitation [40.1].

hhh. Claim 87

[87.1]

Walton/802.11a/Hamabe renders obvious Limitation [87.1] for reasons discussed in Limitations [19.1], [19.9], and [19.10]. EX1002, ¶224. Specifically, the network's current 802.11 channel is determined using interference avoidance determinations from the first and second terminals, which a POSITA would have understood should both be considered in determining a new channel, in the event that notifications have been received from both mobile stations since the last channel selection by the access point. *Id.* Once the network's new channel is determined and the devices switch into the new channel, the filtered first transmission signal from the first station and the filtered second transmission signal from the second station are transmitted using a first and second frequency, respectively, for reasons discussed in [19.9] and [19.10]. *Id.*

iii. Claim 88

[88.1]

See Limitations [19.9] and [19.10].

jjj. Claim 89

[89.1]

Walton/802.11a/Hamabe renders obvious Limitation [89.1] for reasons discussed in Limitation [19.9] and [19.10]. EX1002, ¶226. Specifically, Walton discloses that a MIMO OFDM transmission channel refers to "***each*** spatial subchannel of each frequency subchannel." EX1007, [0048]. Each spatial subchannel is one of the "N_C independent channels" "formed by the N_T transmit and N_R receive antennas," where N_C is the smaller of N_T and N_R. EX1007, [0046]. As explained above with respect to MIMO, generally, this means that each frequency subchannel can be used to simultaneously transmit a separate data stream to each of the receiving nodes in a different spatial subchannel. EX1002, ¶226; *see* EX1007, [0055], [0065]. Based on this disclosure, a POSITA would have understood Walton to disclose using the same set of frequency subchannels, but different spatial channels, to transmit two separate data streams to two separate receiving nodes. EX1002, ¶226. This would occur if, for example, two terminals were scheduled for downlink transmission on all available OFDM frequencies, but in different spatial subchannels. *Id.* Therefore, Walton/802.11a/Hamabe discloses simultaneous transmission wherein the filtered first transmission signal and the filtered second transmission signal are transmitted using the same one or more frequencies. *Id.*

kkk. Claim 90

[90.1]

Walton/802.11a/Hamabe renders obvious Limitation [90.1] for reasons discussed in Limitation [89.1]. EX1002, ¶227. Specifically, transmission using the same one or more frequencies is, by definition, transmission using the same frequency band. *Id.*

lll. Claim 91

[91.1]

Walton/802.11a/Hamabe renders obvious Limitation [91.1] for reasons discussed in Limitations [19.9], [19.10], and [22.2]. EX1002, ¶228. Because the available transmission channels are defined by the current frequency channel (i.e., they are the spatial channels of each OFDM subcarrier in the frequency channel), the frequencies used by the access point to transmit to each station in the network are necessarily based on the network's current frequency channel, which is based on the interference avoidance notifications, which may be received both from the first and second terminals. *Id.* Therefore, the signals transmitted by the access point to other stations in the network after switching channels pursuant to these notifications are filtered transmission signals that are transmitted using frequencies that are based on the claimed instruction and the claimed another instruction received from the third node. *Id.*

mmm. Claim 92

[92.1]

Walton/802.11a/Hamabe renders obvious Limitation [92.1] for reasons discussed in Limitations [87.1] and [89.1]. EX1002, ¶229. Specifically, the OFDM subcarrier frequencies (or, in Walton, "frequency subchannels") to be used for each transmission signal are selected from within the current 802.11 channel and are, therefore, based on the interference avoidance notifications (instructions) used to determine the current channel. *Id.*; *see also* EX1009, 11/90, 31/90. Further, as described in Limitation [89.1], Walton teaches that the filtered first and second transmission signals may be transmitted using the same frequency, but in different spatial subchannels, rendering obvious the remainder of Limitation [92.1]. EX1002, ¶229; *see also* EX1007, [0055], [0065].

nnn. Claim 93

[93.1]

See Limitation [87.1].

ooo. Claim 95

[95.pre]

To the extent the preamble is limiting, Walton/802.11a/Hamabe renders obvious Limitation [95.pre] for the reasons for Limitation [19.pre]. EX1002, ¶231. The mapping of claim 95 employs the same architecture as the mapping of claims 19, 52, and 53, but the first/second/third nodes are mapped differently as follows: a [blue] access point 104 is the "***second*** node," "and two [green, red] terminals" 106a and 106n in the form of 802.11 stations are the "***first***" and "third" "nodes." EX1007, [0076], FIG. 2A; EX1002, ¶231.

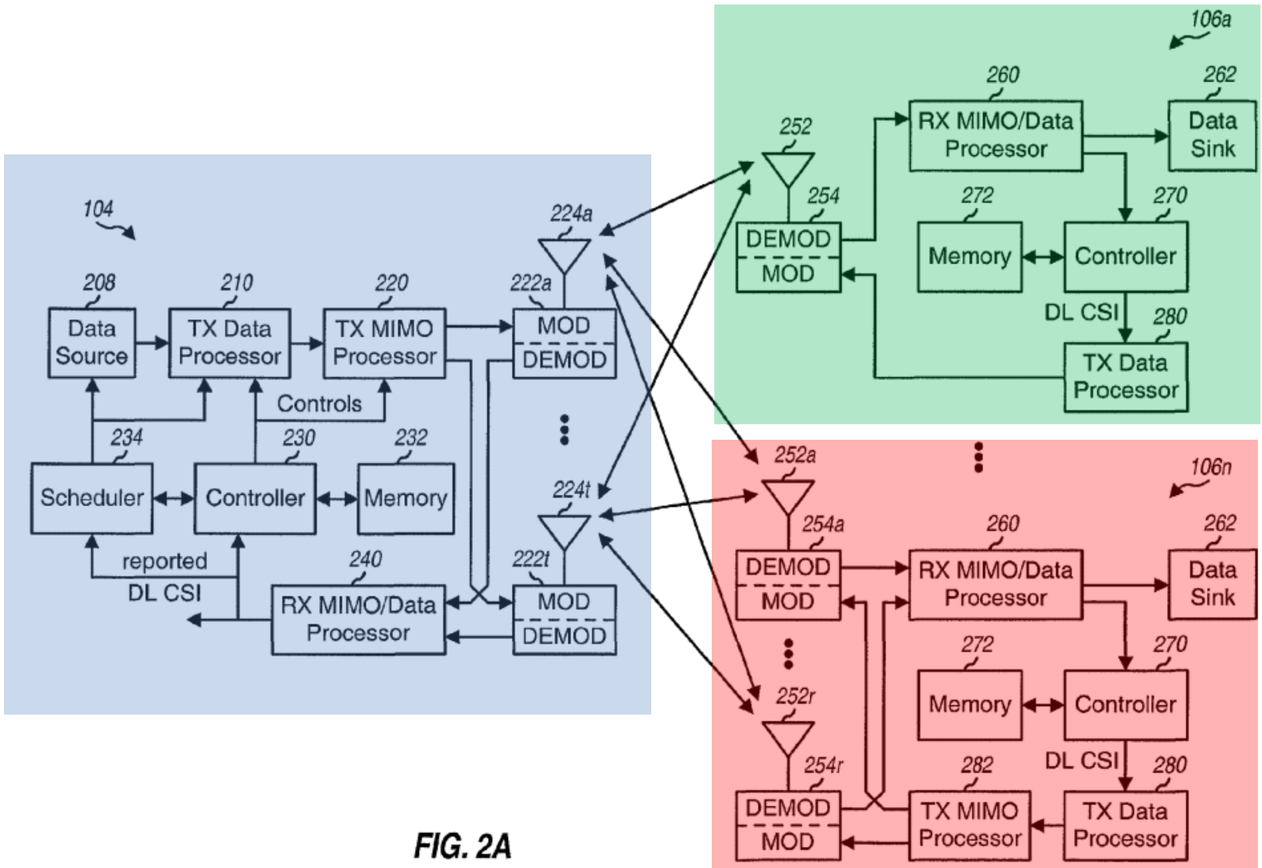

FIG. 2A

EX1007, FIG. 2A (annotated).

[95.1]

Walton/802.11a/Hamabe renders obvious Limitation [95.1]. EX1002, ¶232. In one embodiment of Hamabe, each mobile terminal, including terminal 106a ("first node"), "notifies" the access point ("second node") of interference "measurements." EX1008, [0143]. If access point 104 "determines that the carrier frequency must be changed," it selects a new channel and "notifies the selection to the" terminal, "which will change the carrier frequency to the selected carrier frequency." *Id.*, [0144]. Thus, terminal 106a receives an instruction from access point 104 to use the second channel and, therefore, avoid a plurality of frequencies not used by that second channel, to transmit to access point 104. EX1002, ¶232.

[95.2]

Walton/802.11a/Hamabe renders obvious Limitation [95.2]. EX1002, ¶233. As discussed for Limitation [19.2], a station, including terminal 106a, will perform standard 802.11a standard channelization (EX1009, 11, 34-36/90) and "PPDU encoding process," "time windowing," and "spectral mask" requirements (*id.*, 15-19, 37/90) for the newly-selected 802.11a channel. EX1002, ¶233. As explained for Limitation [95.2], this meets the "filtering" step under PO's infringement theory. *Id.*

[95.3]

See Limitation [19.3] and [95.2].

[95.4]

Walton/802.11a/Hamabe renders obvious Limitation [95.4]. EX1002, ¶235. "At ***each*** terminal 106 for which a data transmission is directed," the terminal "receive[s] the transmitted signals" and, which "active," "[yellow] RX MIMO/data processor 260 [] estimates the conditions of the downlink and provides channel state information (CSI) … indicative of the estimated link conditions." EX1007, [0079]-[0080]; [0316] ("The CSI may be derived based on the signals transmitted by the [access point] transmitter unit and received at the [terminal] receiver unit."). That includes deriving the CSI "based on a pilot included in the transmitted signals" or "based on the data included in the transmitted signals." *Id.*, [316]. Thus, terminal 106a receives particular signals transmitted from access point 104, all such signals other than the message including the instruction being separate from the instruction. EX1002, ¶235.

[95.5]

See Limitations [19.4] and [95.4].

[95.6]

See Limitation [19.4].

[95.7]

See Limitations [19.4], [19.9], and [19.10].

[95.8]

See Limitation [19.9].

[95.9]

See Limitation [25.1].

ppp. Claim 96

[96.1]

See Limitations [95.1] and [95.3].

[96.2]

Walton/802.11a/Hamabe renders obvious Limitation [96.2]. EX1002, ¶242. 802.11-1999, incorporated by reference into 802.11a, discloses that "mobile stations may move from one BSS to another (within the same ESS)." EX1025, 28/528. Because each BSS is managed by a single access point, a mobile station moving from one BSS to another will cease being associated with the first access point ("second node," as described in Claim 95 above) managing the first BSS, and reassociate with a second access point (a "third node") that serves as the access point for the second BSS. *See* EX1025, 27-29/528; EX1002, ¶242. Walton similarly teaches that there may be multiple cells in the larger network, each serving a particular geographic area and managed by a different base station/access point. *See* EX1007, FIG. 1. Walton also explicitly contemplates that a mobile device (e.g., 106g in FIG. 1) may communicate with more than one base station/access point during operation. *See id.* Further, it was known in the art that it is beneficial to handoff mobile devices between base stations/access points as they move to achieve improved signal strength by associating the mobile device with whichever access point it is closest to or receiving the strongest signal from at any point in time. EX1002, ¶242.

Based on the above disclosure in 802.11a and Walton, a POSITA would have understood that a mobile station ("first node") that moves from a first BSS managed by the first access point 104 ("second node") to a second BSS managed by a second access point 104 ("third node") may then receive an instruction transmitted from the second access point 104 to avoid using a different plurality of frequencies to transmit to the second access point 104 via Hamabe's interference detection method described in Limitation [95.1]. *Id.*, ¶243. A POSITA would have understood that the plurality of frequencies is likely to be different because each BSS is serving a different area and may be receiving interference in different frequency channels from different sources as a result. *Id.*

[96.3]

Walton/802.11a/Hamabe renders obvious Limitation [96.3] for reasons discussed in Limitation [95.2]. EX1002, ¶244. Specifically, when the mobile station ("first node") receives Hamabe's channel selection message and moves 802.11 channels, as described in Limitations [95.1] and [95.2], but the channel selection message comes from the second access point 104 ("third node") described above, the mobile station is filtering a second transmission signal to remove power from the second transmission signal at each frequency in the different plurality of frequencies to be avoided. *Id.*

[96.4]

See Limitation [95.3].

B. Ground 2: Walton, Hamabe, 802.11a, and Gubbi Render Obvious Claims 47 and 48.

1. Gubbi

Gubbi discloses "[q]uality of service extensions for multimedia applications communicating across a computer network" to address "existing issues that apply to

802.11 WLANs." EX1020, 5:59-63. These issues include "unacceptable latencies" for multimedia streaming data caused both by (1) 802.11's contention scheme in 1999 (i.e., the "Point Coordinator Function (PCF)"), which cannot guarantee a streaming device access to the channel with certainty within the window required to maintain a stream that appears uninterrupted to the user; and (2) the requirement that all communications pass through the access point (AP), rather than allowing for peer-to-peer data transfers. *Id.*, 4:62-5:15.

Gubbi addresses these issues in 802.11-1999 by "enhanc[ing] the 802.11-MAC to provide QoS [Quality of Service]," while "maintain[ing] complete compatibility with the current definition of 802.11-MAC." *Id.*, 6:15-23. Specifically, the 802.11 MAC layer extensions disclosed in Gubbi allow for "dynamically negotiating for the priority, bandwidth and the retransmission parameters for each [multimedia] stream separately" so that "latency control is achieved." *Id.*, 6:7-11.

In addition to the MAC enhancements to coordinate channel access priority, Gubbi also discloses the use of a "Proxy Point Coordinator (PPC)" to "provid[e] data repeater services" between two devices in the same network." *Id.*, 10:40-45. A PPC is useful when the PPC "recognizes that a request from an MMS [multimedia device] is going unanswered by the operating PC [point coordinator (typically, the AP)]." *Id.*, 15:30-33; *see also id.*, 22:44-55. In such a case, "the PPC forms a tunnel between the operating PC and the requesting MMS by repeating the frames transmitted from either network component to the other." *Id.*, 15:39-42; *see also id.*, 22:6-11. Further, "[e]xtending the above mechanism, two devices might be connected via more than one PPC." *Id.*, 22:12-13. Gubbi also discloses a set of 802.11 MAC commands that may be used "to request the service of a PPC upon recognizing that a link between [a multimedia device] and another device, including the PC, is too poor for proper communication." *Id.*, 39:53-56; *see id.*, 39:48-41:64.

2. *Motivation to Combine*

A POSITA would have been motivated to further combine Walton/802.11a/Hamabe with Gubbi because Gubbi explicitly teaches that its methods are "a supplement to the scheme proposed in the 802.11 standard for wireless networks" that address "existing issues that apply to 802.11 WLANs" that limit their ability to support streaming media. EX1020, 5:56-63; *see* EX1002, ¶249. Gubbi's additions to the 802.11 MAC layer also "maintain[] complete compatibility with the current definition of 802.11-MAC." EX1020, 6:21-23; *see* EX1002, ¶249. Because the Walton/802.11a/Hamabe combination is based on the 802.11 standard and adopts its MAC layer functionality, *see* EX1009, 12/90 ("[t]his subclause describes the PHY services provided to the IEEE 802.11 wireless LAN MAC"), a POSITA would have understood Gubbi's explicit teachings that its MAC layer enhancements may improve 802.11 devices without requiring substantial modification to the existing MAC layer as an obvious motivation to combine it with Walton/802.11a/Hamabe. EX1002, ¶250; *see also* EX1020, 5:56-63, 6:21-23.

3. Modification of Walton/802.11a/Hamabe in view of Gubbi

The Walton/802.11a/Hamabe combination is modified by Gubbi to add Gubbi's 802.11 MAC layer enhancements, which includes the ability of a station to act as a PPC between two devices in the network, and the associated 802.11 MAC commands to facilitate this network topology. EX1002, ¶251; *see* EX1020, 10:40-45, 39:48-41:64.

4. Element-by-Element Analysis

a. Claim 47

[47.1]

Walton/Hamabe/802.11/Gubbi renders this Limitation obvious. EX1002, ¶252. Specifically, Gubbi discloses a network topology for 802.11 WLAN in which a "Proxy Point Coordinator (PPC)" is used to "form[] a tunnel between the operating PC and the requesting MMS by repeating the frames transmitted from either network component to the other." EX1020, 15:39-42; *see also id.*, 22:6-11. Further, "[e]xtending the above mechanism, two devices might be connected via more than one PPC." *Id.*, 22:12-13. Gubbi also discloses a set of MAC layer commands to manage requests for a PPC, the instantiation of a PPC relationship, and broadcasts to the network of new PPC relationships. *Id.*, 39:48-41:64. Gubbi further teaches that "the PPC is allowed to modify the From-DS and To-DS bits in the MAC header and insert its own address in the from -DS address field." *Id.*, 22:6-11. Therefore, through both the MAC layer commands to create a PPC relationship between two nodes and, alternatively, by allowing the PPC to modify the MAC header of packets to be forwarded from the PC to the MMS, or vice versa, Gubbi discloses a network wherein network forwarding decisions are guided using instantaneous information from a media access control (MAC) layer. EX1002, ¶252.

b. Claim 48

[48.1]

Walton/Hamabe/802.11/Gubbi renders this Limitation obvious for reasons discussed in Limitation [47.1]. EX1002, ¶253. Specifically, Gubbi discloses that a PPC may be used to address an MMS whose requests are "going unanswered by the operating PC," which also means that there is an increase in latency of the multimedia stream being received or transmitted by the MMS. EX1020, 15:31-34; EX1002, ¶253. Gubbi's disclosure of a PPC stepping in to forward messages between a MMS and the PC to meet the latency requirements of the MMS (which is streaming) discloses a network in which network forwarding decisions are guided (using a PPC) to eliminate a dominant end-to-end latency effect of channel access delay (the inability of the MMS to contact the PC, resulting in higher latency) across at least one hop (between the MMS and the PC). EX1002, ¶253.

X. CONCLUSION

Petitioner respectfully requests cancellation of the Challenged Claims.

Date: June 16, 2025

By: /Eagle H. Robinson/
Eagle H. Robinson
Reg. No. 61,361

Lead Counsel for Petitioner

CERTIFICATION UNDER 37 C.F.R. §42.24

Pursuant to 37 C.F.R. § 42.24(a)(i), the undersigned certifies that this Paper—exclusive of the table of contents, mandatory notices under § 42.8, certificate of service, and this certificate of word count—includes 13,582 words.

Date: June 16, 2025

/Eagle H. Robinson/
Eagle H. Robinson (Reg. No. 61,361)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105(a), the undersigned certifies that on June 16, 2025, complete copies of this Petition for Inter Partes Review, Petitioner's Power-of-Attorney, and EX1001-EX1010, EX1012-EX1018, EX1020, EX1022-EX1026, and EX1029-EX1042 were served on PO at the correspondence addresses of record listed below by USPS Priority Mail Express®:

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